Electrical APRIL 1945 Contracting

THE MAGAZINE OF ELECTRICAL CONSTRUCTION & MAINTENANCE



in this issue . . . flexibility plus industrial power distribution . . . shop ideas from subway motor maintenance . . . how to install electrostatic spray painting and detearing equipment . . . department store lighting

16,000,000 GE ballasts have been installed since 1938 ... 99.5 per cent are still going strong

FLUORESCENT-FIXTURE MANUFACTURERS G-E ballasts are a powerful sales feature to add to your product.

FLUORESCENT-FIXTURE BUYERS:

Ballasts are an important component. Specify G-E
—to help assure good performance, negligible
maintenance, and long life of your fluorescent
installations.

HERE'S a recent report from a Midwestern bomber plant: "The 12,000 G-E ballasts we installed in 1942 have been operating round-the-clock ever since. To date there have been only six electrical failures." A performance record 99.99 per cent perfect!

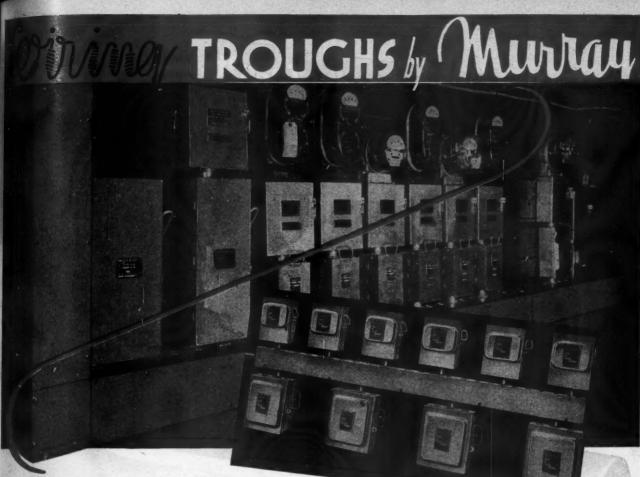
This experience is not unique. Even the *over-all* operating record of G-E ballasts—which are now powering more than a billion watts of fluorescent lighting in America's war plants—is better than 99.5 per cent perfect.

Other outstanding features of G-E ballasts are: quiet operation—assured by an unusually close fit between core and coils and a rigid clamping structure; cool operation—assured by use of low-loss materials, and a special insulating compound that rapidly dissipates heat; matched characteristics—matched with the lamps they are to operate to assure rated lamp life and rated light output; adaptability—convenient dimensions that permit a standard-width wiring channel for practically all fixtures, thus helping fixture manufacturers reduce cost and simplify their parts inventory.

For information on our complete line, ask for our newly revised catalog (No. GEA-3293F). General Electric Co., Schenectady 5, New York.

GENERAL & ELECTRIC

Buy all the BONDS you col
—and keep all you buy



that keep
the
TOUGHEST
"GANGS"
in line

No matter how complicated, how long or how many turns (ever-ready elbows do the trick), Murray Wiring Troughs are easy and quick to install. They are strong and rigid when in place, yet easy to get into, through instantly removable covers. Tap for a branch anywhere—always a knockout handy. Four lengths—and four depth-width combinations. The installations above are typical—and the first you put in will look just as shipshape and prove the easiest job you can remember. Metropolitan Device Corporation, Brooklyn, N. Y.



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The roomy, streamlined Form 35 "Unilet" above is only one of more than 15,000 items in the complete Appleton line of fittings, boxes and lighting fixtures, bracketing every electrical requirement from simplest to most exacting. All

made to highest quality specifications in Appleton's own foundries and fabricating plants.

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A practical technical and management journal for electrical contractors, inspector, engineers and motor the second allation, repairing, maintained and maintenance,

Electrical Contracting, Artic 19

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RAMDOUPH AVENUE



LLIS-CHALMERS Power Transformers are designed and built for continuity of operation with minimum of maintenance.

In spite of increased industrial loads demanded by the war effort, these transformers have operated far beyond their rated capacity for extended periods without interruption, without other than routine maintenance. That's performance!

It is a source of considerable satisfaction to us that Natvar insulating materials, because of their high uniformity, were selected for this important application.

What are your requirements? Write, wire or phone us for deliveries either from the stock of a wholesaler near you - or direct from our own.



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AVENUE RANDOLPH

WOODBRIDGE

FIRST AID FOR MOTORS

MOTORS RUN A FEVER? No wonder if they do more often today. They're working 3 and 4 times as many hours as in peace!

Wartime conditions demand you diagnose motor ailments quickly ... remedy the trouble at once. At right are but few of the many diagnoses found in Allis-Chalmers' new "Guide to Wartime Care of Electric Mo-tors". In maintenance as in war, attack is the best defense. This book singles out the 9 main enemies of electric motors . . . tells you how to get them before they get your motors!



Over 100,000 copies already in use.

Write today for your free copy. Allis-Chalmers Mfg. Co., MILWAUKEE 1, WIS.

SYMPTOMS YOU CAN SEE

Symptom	Possible Causes	Cure
1. Excessive sparking or flashing at brushes.	Rough commutator.	Sand or turn down, depending upon depth of surface roughness.
Blackened commutator.	Low bar on commutator.	Grind or turn down balance of commutator.
	High bar on commutator.	If extreme, lower with mallet, tightening clamping ring. Grind true.
	Brushes too short.	Replace with harder grade—if worn too soon and not by rough commutator.
	Shorted armature winding.	Test for short—after removing metallic contact between commutator bars. Repair.
2. Intermittent sparking at brushes.	Open armature winding.	Locate and replace bad coil—or repair defective joint.
3. Motor won't start.	Usually line trouble.	Correct. Check source of power supply.
	Load too heavy. See if motor runs without load.	Reduce load—or replace motor with unit of greater capacity.

SYMPTOMS YOU CAN HEAR

4. Excessive hum,	Uneven air gap. Measure with feelers.	Replace bearings—before introduction of scraping noise indicates rotor is rubbing.		
	Unbalanced rotor. Check on parallel bars.	Balance with solder on band—or weight attached by cap screw and lock washer.		
5. Regular clicking.	Matter in air gap.	Take out rotor; remove matter.		
6. Rapid knocking	Misalignment.	Realign set until knocking disappears.		
7. Brush "chatter."	Extreme vibration.	See item 10, below.		

SYMPTOMS YOU CAN FEEL

tomor men	C
9. Motor overheating.	0
(Check with thermome-	C
ter — don't depend on	ra
hand).	D

8. Vibration.

Misalignment.

Vibration in driven machine.

Overload. Measure load; compare with nameplate rating.

Dirt in motor. Check flow of air.

Rotor rubs stator.

Realign set.

Eliminate source in machine, if possible. Or a flexible belt drive may be in order.

Check for excessive friction in motor, drive or machine. Reduce load, or replace motor with greater capacity unit.

Blow out motor. Use solvent on wound section if necessary.

Replace bearings.

A 1638



ALLIS-CHALMERS MOTORS

When you do need new motors, look into the strength, solidity and all-around protection of the new "Safety Circle"—protected top, sides, ends and bottom.





COMPACT, self-contained G-E unit substations are "strong points" of modern power distribution

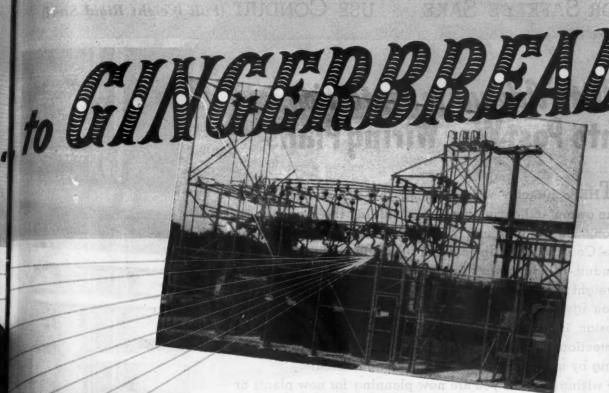
It seems incredible. But the fact is that each of the two factory-built G-E unit substations you see above handle one-third more power than the entire conventional (gingerbread) layout at the top of the opposite page. They do it with lower electrical losses, and afford greater protection for personnel. Installed as a part of a well-planned, modern power-distribution system, they help to assure greater continuity of power to every point of use.

G-E unit substations practically eliminate the manpower problems of assembly on the job. They come ready to connect, combining the necessary transforming capacity, cable-termination facilities, and high-voltage and low-voltage switchgear. The transformer section of each unit is sealed against dirt and dampness. With Pyranol*, which can't burn, these substations can go anywhere, outside or indoors. The metal-clad switchgear isolates each circuit and circuit breaker in a separate, grounded compartment. Vertical-lift breakers have interrupting capacity fully adequate for any emergency.

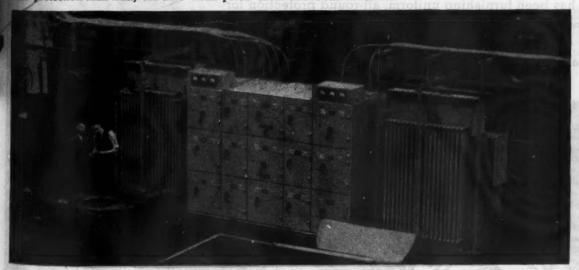
A plant power system that combines several unit substations close to the load centers is highly flexible. Increased loads can be met, step by step, with duplicate units. And war-plant records of "unit subs" in service show unusual savings in maintenance and manhours. Ask your G-E representative for the story. General Electric Company, Schenectady 5, New York Trade-mark Reg. U.S. Pat. Off.

Buy all the BONDS you can-and keep all you buy

Elect



WHAT A CONTRAST between the two modern G-E unit substations on the opposite page, which serve nine 300-hp pump motors, and the layout above, which serves only three 500-hp pump motors. Yet even the gingerbread substation above affords better protection than many old-time "briar-patch" installations still in service.



INDOORS, EVEN MORE ADVANTAGES are made possible by G-E unit substations combined in a co-ordinated, load-center distribution system. They can be placed in factory work-areas, thus keeping short the heavy-copper secondary circuits, and overcoming voltage-drop problems economically. Unlike open switchboards and oil-cooled transformers, they need no isolation wards indoors.



GENERAL & ELECTRIC

Write "Adequate Protection" into Post-War Wiring Plans

THE contractor who installed this wiring system has given the owner and occupants of the building the maximum in protection. He has fully met the high standards of the National Electrical Code by installing standard-threaded full-weight rigid steel conduit -- Youngstown's Buckeye Conduit.

Full-weight rigid steel conduit is the only recognized adequate protection against short circuits from moisture, vapor, dust, dirt, or explosion, in hazardous locations and occupancies. It is the best protection against vibration and crushing. It discourages tampering by unauthorized or well-meaning amateurs.

In the wiring systems you are now planning for new plants or for plant reconversion, you can guarantee adequate protection in this same way, by specifying Youngstown's full-weight rigid steel conduit -- Buckeye Conduit.

Buckeye has been furnishing uniform, all-round protection for electrical wiring for more than a third of a century. Preferred by leading contractors, it is available through distributors from coast to coast.



trolytic Tin Plate-Coke Tin Plate-Bars-

Electrical Contracting, April 1945

CARBON - ALLOY AND YOLOY



Of course the Sheik is confused by Laytex-insulated wire. He's one of the countless number of men now seeing wire for the first time. In hot deserts and tropical jungles, in distant islands and freezing arctic lands—places where electricity has never before been harnessed, Laytex is demonstrating its marvelous properties as a wire. To many of the people in these lands, wire henceforth means Laytex.

But to us here at home, Laytex is more than the average wire. Under the strain of world-wide war, Laytex gives better performance than was ever expected of any wire under such gruelling conditions.

Military needs now take the entire output of Laytex Wires and Cables. But we hope the day is not far off when manufacture will be resumed for Residential and Commercial Building, Police and Fire Alarm Systems, Communications, Signalling, Power Control and other exacting services.

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U.S. Caylex

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Serving Through Science

UNITED STATES RUBBER COMPANY

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1 1945



SANGAMO TIME SWITCHES FOR FLOODLIGHTING PROTECTION

• There are types to meet every protective lighting control need. The complete line includes Astronomic Dial, Synchronous Carry-Over, and Outdoor Time Switches. Form VSWZ Astronomic Dial Time Switch is shown above. Current interruptions up to 10 hours will not stop it nor affect its "on" and "off" settings.

Floodlighting is purchased as a protection for life, property, and production. Therefore, purchasers of floodlighting don't stop there if they know that the floodlighting they buy can be safeguarded from failure.

A SANGAMO TIME SWITCH is set at a designated "on" time and for a designated "off" time—no dependence at all on the human element—no chance for an accidental turnoff.

The sale of this floodlighting protection becomes an added profit for you—not only for immediate floodlighting sales, but for installations previously made.

Our catalog tells about installation—range of application—construction—and complete range of types of SANGAMO TIME SWITCHES.

SANGAMO ELECTRIC COMPANY SPRINGFIELD

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"Let ME KNOW BY WIRE!" "In answer to your wire!" You hear it everywhere, and this use of wire for telegram is tribute to the almost incredible network of wires by which Western Union serves the nation. And few facts in turn, speak so eloquently of the dependability of VINYLITE plastic wire and cable insulation as its widespread adoption by Western Union.

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il 1945

Among many applications in its offices, this great communications -

leader uses instrument wire with VINYLITE plastic primary insulation, and no outer covering. Such wire forms the connections on distributing frames and switchboards. It is used on stationary apparatus and carriages in motion, and has better heat resistance than former materials. But wherever used, inside or out, Western Union has found the thinwall construction of VINYLITE plastic insulation of outstanding value. Its extreme flexibility, re-

sistance to aging, flame, moisture, abrasion, and most chemicals bring new standards of life and performance.

Specify VINYLITE plastic insulation for your own applications. Write Department 41 for your copy of "VINYLITE Plastics for Wire and Cable Insulation."

BAKELITE CORPORATION

Unit of
Union Carbide and Carbon Corporation

30 EAST 42ND ST., NEW YORK 17, N.Y.

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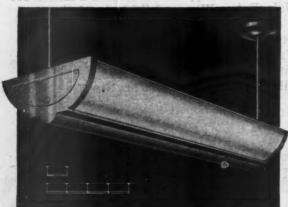
600 WEST POINT STUDY-ROOMS Relighted with GUTH "Cadet" Indirects!



Foot-Candles **Plus** Correlated Brightnesses Scientifically Relieve Eyestrain!

The intensive course of study given West Point Cadets during their 4-year period, is probably the most rigorous and the most sustained seeing-test to which man is subjected. To provide best possible seeing-conditions for the critical seeing-tasks involved, all West Point study-rooms have recently been equipped with highest quality of illumination.

High-intensity illumination has been provided, PLUS uniform distribution of lighting, PLUS shadow-free features, PLUS low-brightness luminaries, PLUS correlated brightnesses throughout the entire room area. The studyrooms were painted to complement the illuminating system. Specific details of the installation are given at the right.



Guth "CADET" is a Luminous Indirect Luminaire for use with two rows of either 40-watt, or 100-watt Fluorescent Lamps. CADET is suspended on single-stem hangers, and is constructed for individual or continuous row installations. The translucent cream-white reflectors direct approximately 75% of the light upward, and 10% downward. Room-ceilings should be painted Albino White to cooperate with the lighting system. Average fixture brightness of 40-watt CADETS is 221 Foot-Lamberts; 375 F. I. for 100-watt CADETS. Fix-tures are 48½" and 60½" long respectively, and should be suspended from 20" to 36" from the ceiling. All metal portions of CADETS are finished "300° White". Listed by Underwriters' Laboratories, Inc.

INSTALLATION DATA

WEST POINT, NEW YORK

The typical West Point study-room is 14' 0" long by 15' 4" wide, with 10' 8" ceiling height. LIGHTING is provided by three Guth CADETS, each 961/8" long and each equipped with 4-40 watt White Fluorescent lamps (2.9 watts sq. ft.). Fixtures are suspended 17" from ceiling to top-of-reflector; fixtures are on 3' 9 centers, and are run parallel to the 14'0" room-length. ROOM-PAINTING COLORS were selected to co-operate with the illumination system. The entire ceiling, plus 12" top of sidewalls, are painted off-white color with 77% Reflection-Factor. Remainder of side-walls is painted soft-green, having 54% R.F. Floors are painted light-gray and have 15% R. F. BRIGHTNESSES throughout the room are correlated and are of the same order. The four brightest spots on the CADET luminaries average 221 Foot-Lamberts. The four brightest spots on the ceiling average 106 F. L. The brightnesses on the side-walls at eye-level, average 13.8 F. L. FOOT-CANDLE READINGS are very uniform throughout the study area. Horizontal readings on the study-tables (31" above floor) are 45.4 Foot-Candles. Illumination at 45° to vertical, 36" above the floor, and 12" out from the study-table, is 23.7 Foot-Candles. Horizontal illumination at the 4 corners of a 10' 0" square is 29.8 Foot-Candles. SOUND from the fixture is practically eliminated (difference between total noise and background is only 0.5 at sound level of 37.5 decibels). RADIO INTERFERENCE is eliminated by use of one filter in each 8' 0" CADET fixture. STROBOSCOPIC is unnoticeable, in both lamps combined, the peak light-output is 14% above the average light-output. ENGINEERING for the entire installation was done by the United States Engineers, New York District Office. WHOLESALER was the Baitinger Electric Co., Inc., New York City, N. Y.

F. GUTH CO. - 2615 Washington Ave. - Saint Louis 3,



Electrice

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This new booklet gives ratings, sizes, characteristics, dimensions, where-to-use data, and prices of General Electric a-c and d-c motors, 1/16 to 75 hp. Everything you need to know to select these sizes—all in 16 pages!

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Please send me a copy of your Condensed Motor Catalog (No. GEA-4281).

Name.

Compan

Address

City.....

Electrical Contracting, April 1945

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13



These are the comments of busy executives on what Teletalk Intercommunication Systems have meant to them in these war-busy days.

"Teletalk saves 50 to 100 trips a day...ten miles of walking,"-an Iowa foundry.

"Teletalk makes all our plant operations more efficient,"—a laundry machinery manufacturer.

"Teletalk gives us the speed which is the essence of all our contracts,"—a New Jersey concern.

"Teletalk instantly provides 'finger-tip' information to answer 150 long distance telephone calls a day,"—an Illinois company.

These are important problems. Scores of busy concerns in your vicinity are faced with them today. Teletalk provides an effective way to increase your sales volume by showing them Teletalk, the solution to these time-saving problems.

Teletalk gives quick, voice-to-voice contact with every department of a business. It is easy to install, requires little or no service. Teletalk takes its power from the electric light circuit.

Now is the time to increase your revenue and build for future business by selling Teletalk... the modern answer to inter-office and inter-plant communication. Write us today.

Let's All Back the Attack Buy Extra War Bonds



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SAFETY SWITCH WITH "CLAMPMATIC" CONTACTS

BullDog technicians put in years of laboratory research to develop these advanced principles in safety switch design-more years of experimental engineering to prove them. Result: The BullDog Vacu-Break Safety Switch-far ahead of the field!

No other safety switch has the Vacu-Break principle of arc suffocation-Clampmatic contacts tight as a bolted connection

in the ON position, thus reducing heating -simplified mechanism for positive operation-modern streamlined cabinet-ample interior wiring space without sacrificing over-all compactness. Capacities from 30 Amp. to 1200 Amp.

Take the word of top-flight engineers in leading plants of the nation. Or investigate for yourself. Write for illustrated folders.

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1945

SALVAGE PAPER

BOX 177, R. PK. ANNEX, DETROIT 32, MICHIGAN. In Canada: BullDog Electric Products, Ltd., Toronto. Field Engineering Offices in All Principal Cities.



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DUCT, for "plug-in" power — Universal
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by

At the right are listed various types of electrical control equipment designed and furnished by METROPOLITAN for utilities, industrial plants, large mercantile establishments, and public buildings. Your inquiries are invited.

Knife Switchboards
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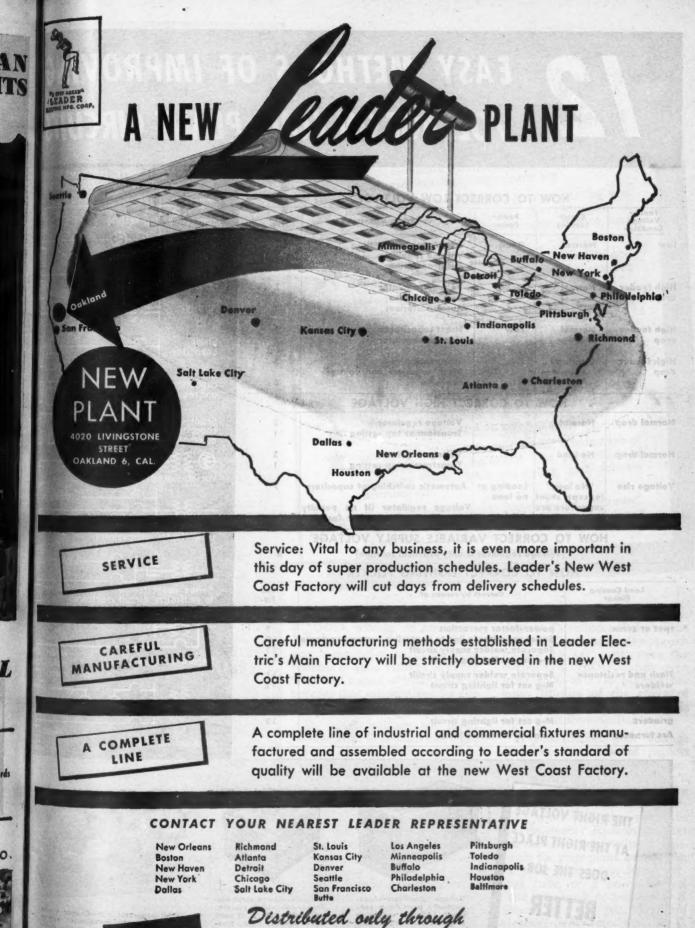
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Electric



MAIN OFFICE the Better Electrical Wholesalers AND FACTORY

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145

2 EASY METHODS OF IMPROVING VOLTAGE ON YOUR PLANT CIRCUITS

Feeder Voltage Condition	Circuit Loading	Power Factor	Correct by means of	See Fig.
Low	Normal	Good	Transformer tap setting Voltage regulator Autotransformer	1 2 3
High feeder drop	Normal "	Good	Voltage regulator Parallel circuit Autotransformer	4 3
High feeder drop	Normal	Low	Shunt capacitors Voltage regulator	5 2
High feeder drop	Overload	Low	Shunt capacitors Shunt capacitor and voltage regulator	5
	HOW	TO CORE	RECT HIGH VOLTAGE	
Mormal drop	Normal		Voltage regulator Transformer tap setting	2
Normal drop	No load		Voltage regulator Transformer tap setting	1
Voltage rise	"No load" (except shunt	Leading at no load	Automatic switching of capacitors Voltage regulator (if no penalty)	7
	on)		clause for leading power factor)	6

HOW TO CORRECT VARIABLE SUPPLY VOLTAGE

(Voltage regulator is only practical solution)

HOW TO CORRECT LIGHTING FLICKER

Load Causing Flicker	Correct by means of	See Fig.
Resistance welders, spot or seam	Series capacitor with welder to reduce demand by power-factor correction Series capacitor in line to neutralize system reactance Separate welder supply circuit M-g set for lighting circuit	9 10 11 12
Flash and resistance welders	Separate welder supply circuit M-g set for lighting circuit	11
Motor loads, such as: sawmills, rubber mills, grinders	Series capacitor in line to neutralize system reactance Separate motor supply circuit M-g set for lighting circuit	10 11 12
Are furnaces	Same as for motor loads	

Transformer tap setting

Voltage regulator

Auto-transformer

Parallel circuit

Shunt capacitor and regulator

Shunt capacitor automatically switched

Wariable supply voltage

Series capacitor for pawer-factor improvement

Series capacitor to neutralize circuit reactance motor, or furnace

Separate supply circuit

Welder, Walder, Wa

SCHEMATIC DIAGRAMS OF CORRECTIVE ARRANGEMENTS





Voltage stabilizers—Automatically provide a constant 115-volt supply to a given load on circuits varying from 95 to 130 volts. Ratings from 50 to 5000 vs. Ideal for procision laboratory or manufacturing. processos. Ask for Leaflert 62A-3034.



Variable-voltage autotrameformer—Provides smooth, adjustable control of voltage, current, light, tamperature, power, and speed at a turn of the dial. Retlage from 243 to 810 vs. Ideal for use in factory and laboratory, Described in Lenter CRA-363.5.



M-g set for lighting

Meter-generator zeta-Change est in dec. Provide an inexpensive way in supply your lighting circuits independent of your power dreams to avoid lighting ficker. See diagram 11 and 12. Described in Lenting 14. Post-1945 (synchronous type), lock-

Elec



They will help you gain some or all of these benefits

Improved lighting (higher levels and the reduction or elimination of flicker); better starting of fluorescent lighting; longer lamp life

Increased motor efficiency; greater starting and running torque and speed; the reduction of motor heating and, hence, maintenance and machine outages

Reduced breakage and spoilage in textile and other mills where motor speeds must be constant

Better performance and greater reliability of electric equipment; the elimination of sluggish operation of potential or control devices

Greater production from electric furnaces, infrared heaters, drying lamps, and a wide variety of other electric equipment

Quality control and greater uniformity, fewer rejects, more accurate test results

Temperature control on heating circuits

Longer life of electric equipment; a reduction of overheating and burnouts; the protection of precision tools, electronic tubes, and delicate instruments

Kva demand reduced, power factor improved, increased circuit loadability and, often, reduced power cost

GOOD voltage is no longer a luxury. It is now easy and inexpensive to extend the benefits of good voltage to every nook and corner of your plant—benefits that quickly pay for the small initial cost of equipment.

By good voltage we mean voltage that is neither too high, nor too low, nor extremely variable. A 10 per-cent overvoltage reduces incandescent-lamp life 75 per cent, decreases the power factor of general-purpose motors from 3 points at full load to 5 and 6 points at half load, and causes overheating in various potential devices. A 10 per-cent undervoltage decreases the light output of incandescent lamps approximately 30 per cent, increases the temperature rise of general-purpose motors 6 to 7

degrees C, reduces their torque and overload capacity approximately 19 per cent, cuts the output of a typical heating oven from 1500 to 1275 pounds per hour. Studies of the effect of poor voltage on other electric equipment show similar losses.

If you suspect poor voltage of being the cause of pepless motors, poor lighting, or production slumps at your plant, we'll be glad to help you make a system study. This will determine what corrective measures are necessary. Remember that whether you need voltage regulation for your plant as a whole, for your laboratory, for a vacuum tube, or a power shovel there is a simple, economical G-E device for the job. General Electric, Schenectady 5, N. Y.



1945



"And who in the Div'l is Raco?"

That's easy, officer. Raco is a trade-marked line of All-Steel-Equip Co. . . . the complete line of steel switch boxes, outlet boxes and conduit fittings that has won the approval of architects, builders and contractors throughout America!

HERE'S WHY YOU, TOO, SHOULD INSIST ON THE RACO · ALL-STEEL · LINE . . .

CLEAN - Smooth, lustrous finish. No dirt, no grease, no chipping or flaking paint, and no rough edges.

PACKAGED — Every Raco product comes to you in attractive cartons... with easy-to-read index showing product number, quantity and finish.

UNIFORM—All Raco Products are made to the same exacting standards as other precision metal products that All-Steel has been manufacturing for more than 32 years.

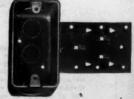
And in addition, Raco·All-Steel·Line is sold nationally through wholesalers only. It's the quality line, the dependable line. Look for the Raco trade-mark . . . the sign of better workmanship.



←400½-O—STANDARD (UTILITY) BOX. Enameled or galvanized finish. With "Side-Mount" Bracket.

400½-B—STANDARD (UTILITY) BOX. Enameled or galvanized finish. With "Face-Mount" Bracket. →

ALL-STEEL-EQUIP COMPANY, INC. 600 Kensington Avenue, Aurora, Illinois



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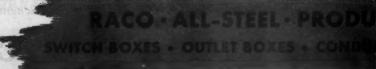
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There is NO SUBSTITUTE for Experienced Technical Skill

When you are planning new or extended electrical systems, future requirements must be given equal consideration to present needs. Corectly engineered switchboards, panelboards and power distribution methods demand careful planning and selection if future requirements are to be considered.

Here is where the ® Sales Engineer can be of real assistance.

Through many years of successful

working with Architects, Contractors and Industrial Engineers he knows your problems. By his daily contacts he has first-hand knowledge of the latest developments in your field. His technical skill is on display in hundreds of installations in your locality. Behind him is a pioneer manufacturer of switchboards, panelboards and power distribution systems. His experience and ability are yours for the asking, so call or write him today.

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There are good reasons why:

- Miller Fluorescent Troffer lighting systems simplify planning. They are engineered to meet structural problems.
- 2 They suggest themes around which to plan the entire structure. They are readily installed in single units, blocks, geometric patterns or light-strips "by the mile".
- 3 They harmonize with all interiors. There is a wide range of glass or plastic lenses, plates, and metal or plastic grilles to meet specific architectural and lighting requirements.
- 4 They simplify construction. Instead of laboriously fitting a lighting system into false ceilings, the patented Miller Bracket makes it possible to hang the ceiling directly from the lighting system.

But how about the *lighting qualities* of Miller Fluorescent Troffer lighting systems?

For 100 years, The Miller Company has pioneered in lighting. It works with all approved light-sources, including mercury-vapor and incandescent. The Miller Company believes that Fluorescent Troffer lighting systems are its very finest achievement.

Miller distributors and field engineers are conveniently located to serve you.

OTHER PLUSSES

OF MILLER FLUORESCENT TROFFER LIGHTING SYSTEMS:

- Supports from structural ceiling reduced 50 to 75%.
- Conduit and conduit fitting costs reduced up to 80%.
- Wiring costs reduced up to 50%.
- Permanent operation and maintenance economies.

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Fluorescent, Incondescent
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Electric



Jumping-off place for small-motor **Jitters!**

Done for, finished, never to be found in your factory is the fractional horsepower motor that gets caught here with the "shakes." For this "green-line" test tells Robbins & Myers engineers when a midget motor has fidgets, when magnetic or mechanical motor unbalance is causing excessive vibration. Needless to say, any design that doesn't purr along smoothly calls for a new start—from scratch.

In this test, all motor vibration on the spring-supported platform registers on the spherical pickup under the motor. This vibration, in turn, registers on the cathode-ray oscillograph where its mag-

nitude and frequency can be studied from the green line on the screen.

This test is but one of many that newly designed R & M fractional motors must pass. Constant checking of data calculations is a habit with R & M engineers, a habit that assures your satisfaction. That's equally true whether those motors are the stock type or are designed for special performance applications.

In either case, our motor development engineers will be glad to discuss your postwar motor needs, now. Talk it over with them (naturally, without obligation) or ask for literature on the R & M fractional motor line. Today isn't a bit too soon.

FREE NEW BOOKLETS!

"SHADED POLE MOTORS," Form No. 1887. "MATCHED MOTOR PARTS," form No. 1871. "UNI-SHELL INTE-GRALH.P. MOTORS," Form No. 1845. "MOTOR GENERATOR SETS," Form No. 1881

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MOTORS - HOISTS - CRANES - MACHINE DRIVES - FANS - MOYNO PUMPS - FOUNDED 1878

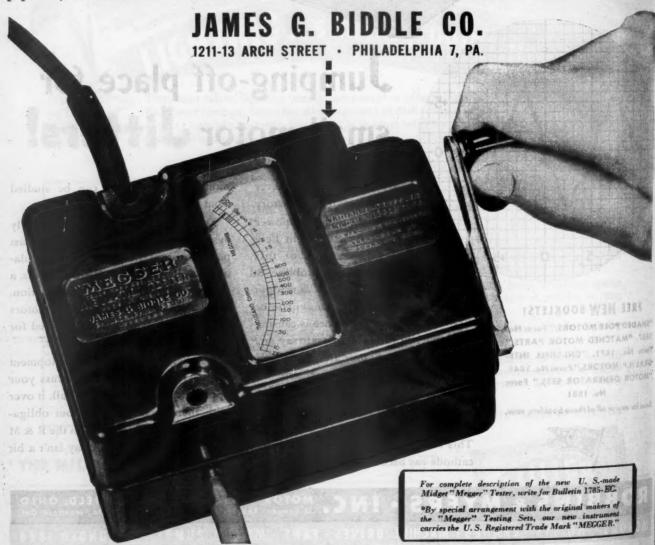
the SECOND U.S.-made "Megger" Instrument ... THE MIDGET "MEGGER"* INSULATION TESTER

Following the production, in June 1943, of the first U. S.-made "Megger" testers, we now announce a second "Megger" instrument being built in our Philadelphia factory—the Midget "Megger" Insulation Tester.

This new U. S. model is identical in design and similar in every way to the Midget "Megger" Insulation Testers we have been supplying for the past ten years, except that the molded plastic housing is mottled brown instead of red.

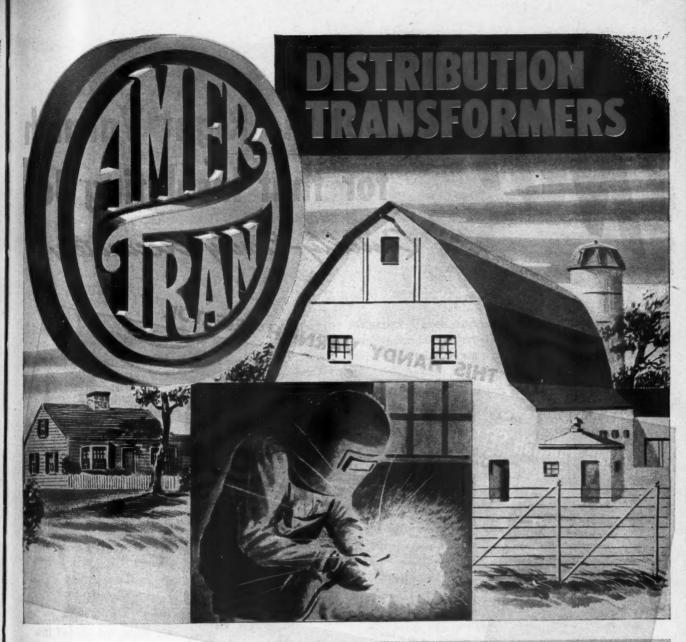
The Midget "Megger" Tester has achieved wide popularity because of its size and low cost. Weighing but 3 pounds, it is always ready to use for testing insulation resistance of a wide variety of electrical equipment. It is indispensable for maint nance and trouble shooting, even where higher range "Megger" testers can be used . . . reads up to 50 megohms and delivers 500 volts d-c from a hand-cranked generator, making it independent of batteries or external power supply. Lower ratings are also available.

Manufacturing facilities are complete and our expanding production makes availability of these new instruments far better than we have previously been able to offer. We invite your orders for them.



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For Post War Rural Applications

Two and one-half million farms now use electric power. Over three million others are considered to be prospective users of electric power. And with many rural electric power projects in prospect for the post-war period, the future of the farmer as a buyer of electrical equipment is assured. At the same time, a study of the trend toward farm mechanization and electrification during recent years indicates that much must be done to improve the transmission and distribution of power in rural areas.

New AmerTran Distribution Transformers for rural service are designed for unusual ruggedness and freedom from trouble. Such qualities are particularly required in rural electrification because of the greater distances involved, the comparative inaccessibility of installations and their exposed locations.

AMERICAN TRANSFORMER COMPANY, 178 EMMET ST., NEWARK 5, N. J. Rectifiers for Electronics and Power Transmission

LOOK FOR THESE ADVANTAGES IN THE NEW AMERTRAN DISTRIBUTION TRANSFORMERS

Lower Exciting Current Increased Overload Capacity Smaller Size - - Lighter Weight Improved Tank Construction **Coordinated Insulation** Improved Regulation · · · New Terminal Facilities Please send me a G.E Insulation Varsish Scheros



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GENERAL ELECTRIC

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Ever since our defense program began to take shape, lighting engineers have been called upon to make lighting recommendations and initiallations that might have seemed impractical a short time before.

In every instance these lighting engineers solved the problems and eliminated bottlenecks that were hindering production of war materials. They lighted war plants covering acres of ground, solved chitical inspection problems and installed equipment to produce illumination levels equal to those outdoors.

These and thousands of other lighting problems required serious thought and sound engineering. The possibilities of incardlescent, mercury vapor or fluorescent lamps had to be explored. But legardless of the decision, regardless of the source used, the lighting engineer assured quiet, troublefree operation by specifying Sola Lighting Transformers.

Tomorrow the lighting engineer and his customers will benefit by many important improvements in design and performance that will be made available when restrictions are lifted.

MERCURY VAPOR LIGHTING: High intensity mercury vapor lamps have been and will be used in many industrial plants where high bay mounting is essential. Ask for Bulletin JMV-76

FLUORESCENT LIGHTING: SOLA ballasts still rate top preference with important fixture manufacturers. Ask for Bulletin JFL-86

COLD CATHODE LIGHTING: SOLA transformers incorporating the famous Constant Voltage principle are now available for operation of the long, slim cold cathode lamps. Ask for Bulletin JCC-104

SERIES LIGHTING: For airport, protective and street lighting or wherever the power supply must be sealed against dirt, dust or moisture, Sola's new Series Transformer is without comparison. Ask for Bulletin JSS-97

Power Distribution transformers of the conventional double wound auto types, either step up or step down, can be used economically in providing the proper supply for lighting installations. Ask for Bulletin JDW-101









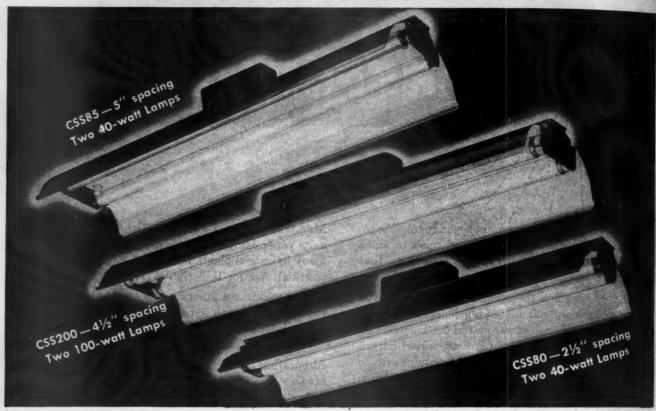


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Transfermers for: Constant Voltage • Cold Cathode Lighting • Mercury Lamps • Series Lighting • Fluorescent Lighting • X-Ray Equipment • Luminous Tube Signs
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HOLDENLINE CHAN'L-RUN



Built to solve the CONTRACTOR'S problems, a HOLDENline Chan'l-Run individual unit installation can be changed in 3 minutes to continuous run!

Brings you these SIX PRACTICAL ADVANTAGES

- 1. Unbeatably swift conversion from individual units to continuous run. To change a HOLDEN-line individual unit installation to continuous, simply remove end caps and join units with connector strap. That's all. No need to stock units of irregular size... and you give the customer a beautiful custom-built job... and make him as proud as a peacock. Saves time and money. Pleases buyers.
- 2. Speed and simplicity of installation saves manhours, cuts costs. Ample room in wireways for service wires—don't worry about space—no interferences, wires run full and free.
- 3. Butt-On Sockets backed by welded-in-steel ends, eliminate socket breakage and guarantee

correct socket spacing.

- 4. High lighting efficiency based on correct photometric design. Chan'l-Run Units feature ease of cleaning—longer life—higher reflection factor.
- 5. Battleship construction. Each unit a tough, long-lasting unit, whose strength is accentuated by continuous run.
- 6. Tested. HOLDENline Units are lighted, not once but three times on 110 volts... must stand up under 1200 volt breakdown test.

Observation: HOLDENline Chan'l-Run saves you money in the shop and on the job. Our clamp-hanger meets any mounting problem—cable, rod or ceiling.

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For further information and a copy of Catalog B-45, contact your nearest wholesaler—or write to

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- Complete Insulation
- Full Protection
- Short Proof
- Shock Proof
- Rust and Corrosion
 Resistant
- Permanent
- Adequate
- Economical
- Maximum Current Capacity Ratings
- Takes Standard
 Devices and Fixtures
- Meets Future Load Increases
- Allow for easily made Alterations and Additions

★ In the next decade rural America is destined to have its face lifted and farm areas will become places of beauty and abundant living, according to Robert F

Gerholz, Flint, Michigan, president of the National Association of Home Builders of the U.S., at their post-war planning exposition and annual convention at the Hotel Sherman which was held in Chicago January 15 through the twentieth.

Mr. Gerholz said, "The building industry is prepared to meet the demand for at least a million new farm homes in America when peace is declared. There are six million farm homes in America today—many of them are obsolete and badly in need of modernization.

"Plans are already off our drawing boards, awaiting the end of the war and the green light from the government to swing into action building these homes. It is conservatively estimated that at least 7% of our G. I. Joes will change their A. P. O. to R. F. D. when they come home."

Contractors at the moment who are encouraging the use of Porcelain Protected Wiring Systems have all this to look forward to—not only are these installations profitable to you but you give the customer a low cost light and power installation that is complete in all ways including safety.

* ILLINOIS ELECTRIC PORCELAIN CO. * PORCELAIN PRODUCTS, INCORPORATED

Macomb, III. Findley, Ohio

*SPECIALTY PORCELAIN WORKS *SUPERIOR PORCELAIN COMPANY *UNIVERSAL CLAY PRODUCTS COMPANY

Fast Liverpool, Ohio Parkersburg, W. Va. Sandusky, Ohio



MODERN PORCELAIN PROTECTED WIRING SYSTEMS





Designers and manufacturers of many types of electrical equipment —from tiny control devices to huge stators—are utilizing the extra mechanical and electrical advantages which

only Fiberglas-base Insulation Materials afford. The use of this better material also assures users of such equipment, greater protection against time and dollar losses.

That Fiberglas gives the extra stamina necessary to overcome changes in operating conditions, human element hazards and many of the other unanticipated causes of trouble and failure, is proved by numerous case histories.

Fiberglas is glass in fiber form—as such, it retains some of the characteristics commonly associated with glass and gains others which make it an unsurpassed insulating material, when properly impregnated. In textile form

Fiberglas provides a thin, extremely strong, flexible, inorganic fabric base for impregnants and is available in such forms as: Magnet wire, Lead wire, Special wires and cables; Varnished cloth and tape; Mica-Combinations; Laminates; Saturated sleeving; Varnished tubing; Presure-sensitive tapes and special products.

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The new illustrated catalog tells how Fiberglas' high tensile strength and favorable space factor solves many problems economically—how Fiberglas-base Insulation Materials successfully combat such common insulation enemies as excessive moisture, corrosive chemicals and high heat. It shows why these better insulation materials are being used in an ever-widening range of applications. Write for your copy today of the new catalog and ask for the name of the Fiberglas Electrical Insulation Materials supplier nearest to you... Owens-Corning Fiberglas

Corporation, 1856 Nicholas Bldg., Toledo 1, Ohio. In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.

Each Distributor of Fiberglas-base Insulation Materials has his own source of supply, since Owens-Corning Fiberglas Corporation does not process these materials.



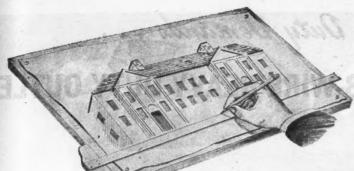
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THE NEXT SHOWINGS ARE: Netherlands Plaza, Cincinnati, March 13-15; Henry Grady Hotel, Atlanta, March 20-21; Tutwiler Hotel, Birmingham, March 27-28; Jefferson Hotel, St. Louis, April 3-4-5-6; Muehlebach Hotel, Kansas City, April 17-18. Locations of showings in Dallas,

April 24-25; Houston, May 1-2, and appearances in other cities will be announced later.



Over half a billion dollars of postwar school building is actually on the drawing boards today!

Business is being you planned for you

... are you ready for it?

• Immediately after the war the greatest school-construction program in our nation's history will be launched. To meet this, Edwards will be ready with the most complete line of school signaling systems in existence! For the first time all types of school signaling are available from a single source through regular distribution channels!

EDWARDS NOW OFFERS "OVER-ALL" SCHOOL SIGNALING SYSTEMS

The newest addition to this accepted line is a clock and program signaling system, powered by the famous Telechron synchronous movement. Together with the well-established line of school telephones and fire alarm systems, this provides "over-all" school signaling from one source.

Plan now to get a desirable volume of this postwar business ... while the schools are still in the blueprint stage. In keeping with the Edwards policy, this "over-all" signaling system will put you in a topnotch position for a topnotch market. Each system is accurate, complete, comprehensive in every detail—a triumph of scientific advancement.

Be ready when the market breaks to furnish Edwards:

- Clock and Program systems (school signaling)
 - Telephone systems (communication)
 - Fire Alarm systems (protection)

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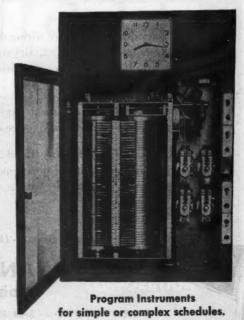
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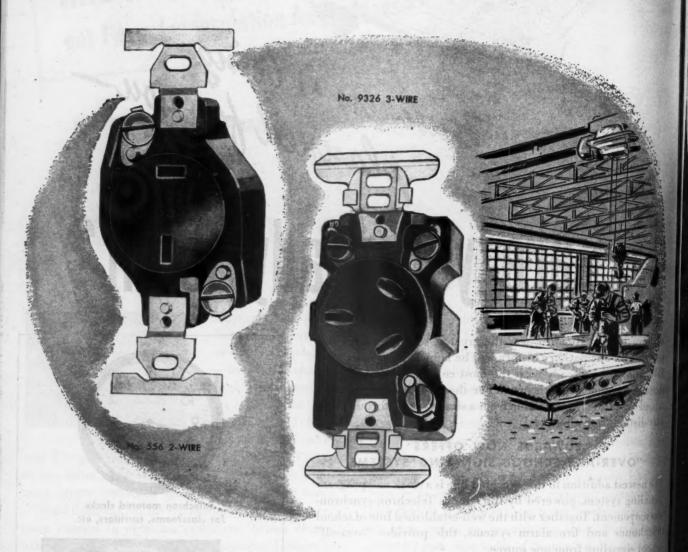
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Telechron motored clocks for classrooms, corridors, etc.



For Heavy Duty Demands . . .

USE BRYANT 2- and 3-WIRE HEAVY DUTY OUTLETS



Heavy duty demands require wiring devices that are built to take punishment. Bryant products are correctly designed for every wiring requirement.

For satisfactory performance, it pays to use the best—these dependable, long-service devices:

2-WIRE OUTLET NO. 556—Rated 20 amperes, 250 volts. Rugged composition housing. Large binding screws with ample wiring space. Top

wired, flush mounting. Takes standard single outlet plate. Also available on 4-inch cadmium plated cover.

3-WIRE OUTLET NO. 9326—Rated 20 amperes, 250 volts. Supplied with or without grounded yoke. Standard single outlet plate can be used. Durable composition housing. Ample wiring space with large terminal screws. Top wired, flush mounting. Available on 4-inch cadmium plated cover.

Specify Bryant Devices from your Electrical Wholesaler

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Manufactured by

THE P. D. GEORGE COMPANY, ST. LOUIS, U. S. A



Your stake in the home wiring market is one of your biggest postwar opportunities. Today's home owner and the postwar home owner is demanding that his home of tomorrow be an electrical home. This means more and better wiring to handle adequately the heavier loads imposed by the increased use of electrical appliances, radios and other conveniences. For you, it means more business and profits.

To take fullest advantage of this greatly expanded wiring market, you will require

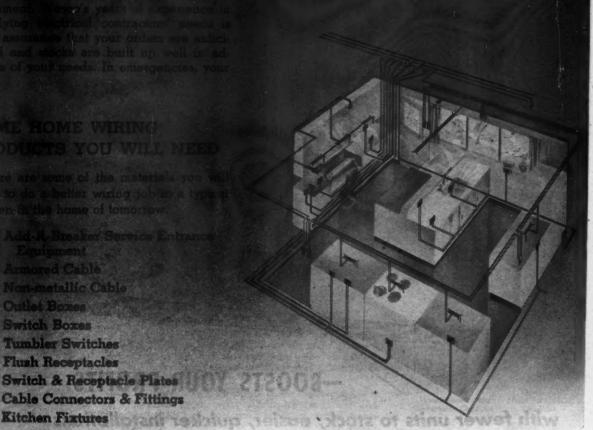
the services of a supplier who can give you quick delivery, usually from stock, of the apparatus and supply materials you will need to do a better wiring job.

Wesco is set up to assure you of complete, prompt and reliable service at all times. In strategically located cities throughout the country, 81 local Wesco offices form a closely knit, efficient distribution system. There is a Wesco Office conveniently near you to give efficient service, fill orders accurately and deliver quickly.

For everything electrical call Wesco

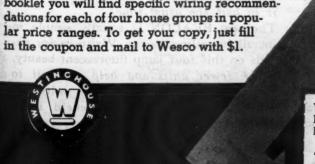
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Outlet Boxes Switch Boxes Tumbler Switches Flush Receptacles Switch & Receptacle Plates Cable Connectors & Fittings



FOR MORE PROFITABLE INSTALLATIONS

To assure you of more profitable better home wiring installations, Westinghouse has prepared a "Handbook of Better Home Wiring" for your use. The principles of better wiring are translated into actual wiring requirements and minimum specifications. In this booklet you will find specific wiring recommendations for each of four house groups in popular price ranges. To get your copy, just fill in the coupon and mail to Wesco with \$1.



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Gentlemen: Please send me the new Westinghouse "Handbook of Better Home Wiring". I enclose \$1 as payment in full.

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You don't have to stock six of one and a half a dozen of the other—not when you handle Wakefield's business-getting new BEACON. This fixture comes ready for im-

mediate ceiling mounting—but is instantly adaptable to stem suspension by use of the Wakefield Stem and Canopy Assembly No. 7.

And not only is the new BEACON always ready to furnish top-flight fluorescent lighting, but it can be installed so much more quickly and easily! Simplified con-

struction helps cut time and labor, increase your profits.

Here's why the new BEACON is easier to mount. You simply slip stems into an already fastened ceiling strap, where they lock themselves firmly by spring action—giving you strength, simplicity and safety. One man can install this fixture—and do it in half the usual time!

The new BEACON is equally simple to install in ceiling mount. Write us for details on this four lamp fluorescent beauty. Stock fewer units and help yourself to realize greater profits . . . with the BEACON. The F. W. Wakefield Brass Co., Vermilion, Ohio.

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Insure enduring satisfaction on your RURAL ELECTRIFICATION jobs by installing sturdy cast metal

CONDULETS

(CONDULETS are made only by CROUSE-HINDS)

There are dozens of Crouse-Hinds CONDULETS, GROUNDULETS and lighting fixtures for use in farm and residential installations. By using this quality material you can put in safe, long-lasting jobs that build good will and bring future business from friends and neighbors.











1945











Type GC ounding Strap



Service entrance CONDULETS and accessories for conduit or cable—GROUNDULET safety circuit equipment
—OBROUND CONDULETS for general wiring—
Switches, plugs and receptacles for indoor or outdoor use—Switch and fuse or circuit breaker CONDULETS for the control of heavy duty circuits.

Safety hand lamps for repair shops and garages-A wide variety of Vaportight lighting fixtures in wall and ceiling types for use as yard lights, in dairies, barns or stables, or in any indoor or outdoor locations where exposed to vapors, moisture, rain or non-explosive dust.

Crouse-Hinds floodlights offer the most efficient method of lighting yards, driveways or any outdoor or indoor location where projected light is desirable. They are economical too! It is often much cheaper to throw the light a considerable distance than to extend wiring and install a local light at that point. You have your choice of a wide beam floodlight or a narrow beam spotlight, with or without a weatherproof glass cover. A spread lens that projects a fan shaped beam is also available. There are Crouse-Hinds floodlights suitable for every lighting requirement.











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Nationwide Distribution Through Electrical Wholesalers



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TRAFFIC SIGNALS
 AIRPORT LIGHTING
 FLOODLIGHTS

Total U. S. Sales of Fluorescent Lamps 1948 BIGGEST
PROSPECT 70,000,000 in LIGHTING McFARLIN and SONS STOR Will You Get Your Share of 1946 Postwar Store Lighting Sales? 52,000,000 mcFARLIN and 1944 37,000,000 1942 mcFARLIN on 32,000,000 meFARLI! 1940 7,000,000 1938 200,000

Electrical Contracting, April 1945

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BIGGEST SALES

Here are eight significant sales features that will help you develop a booming business in postwar commercial lighting... and build up your profits selling G-E Mazda Lamps. Already these profit-points have worked wonders for hundreds of wholesalers and contractors. Why not be sure to include them in your postwar planning?

- Complete Line. General Electric is the source of supply for a full line of lamps for every possible lighting need.
- Versatile Engineering Service. All the technical skill and resources of General Electric are available to give customers best lighting results.
- leadership in Research. General Electric lamp research will continue to provide an increasing number of lighting firsts.

- Public Preference. More and more people prefer General Electric lamps—they are accepted, high quality products.
- Universal Demand. Everybody needs bulbs. Month after month, the year around. G-E lamps provide good steady turnover.
- Complete Advertising Coverage. This year alone, more than 700,000,000 advertising messages will build preference for G-E lamps.
- Consistent Profits. You make a good, fair profit selling G-E lamps a product with no obsolescence or perishable features.
- High Quality. The famous G-E monogram is a mark of excellence in performance—known to lighting customers everywhere.

G-E MAZDA LAMPS

GENERAL & ELECTRIC

Hear the G-E radio programs: "The G-E Ali-Girl Orchestra", Sunday 10:00 p. m. EWT, NBC; "The World Today" news, Monday through Friday 6:45 p. m. EWT, CBS; "The G-E Houseparty," Monday through Friday 4:00 p. m. EWT, CBS.

BUY WAR BONDS AND HOLD THEM



1945



FOR PROTECTION

ALWAYS WHEN NEEDED
AND ONLY WHEN NEEDED

SHAWMUT SHUR-LAG RENEWABLE FUSES AND LINKS



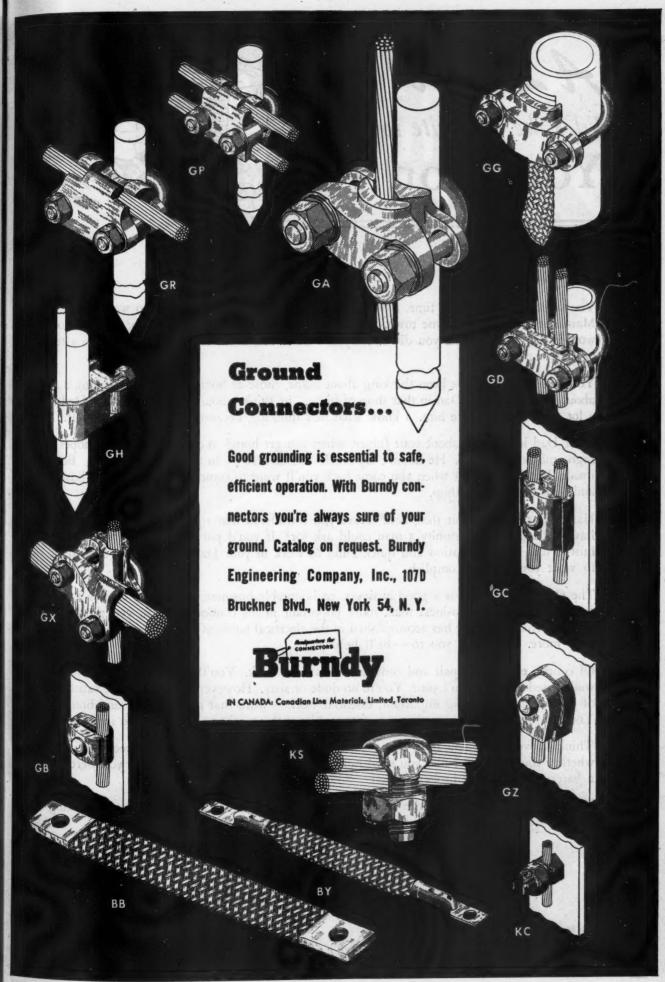
THE CHASE-SHAWMUT COMPANY

NEWDIDVDODT MASSACHUSETTS



SINCE 1893

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Electrical Contracting, April 1945

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pril 1945

A Letter I'd Like to Write to Your Son



Dear Joe:

You've been away a long time, haven't you? Gosh, wouldn't it be swell to walk down Main street in the old home town, and drop in at your Dad's Electric Shop? I'll bet you wouldn't groan now like you did when you were a kid, if he asked you to load up a truck or clean up the shop.

You know while you've been thinking about home, those at home have been thinking a lot about you, too. Your Dad in that shop of his . . . he thinks about you. I know your Dad and a lot of other Dads like him. I know what he's thinking, because I've got a son myself.

Your Dad is thinking about your future, when you get home. Your Dad has high hopes—high ambitions for you. He doesn't say much. He doesn't try to tell you what to do. But inside, he's hoping that when you come back you'll want to come into the electrical business, and help him run his shop.

Have you thought about that, Son? Have you considered that right in your Dad's shop you have the biggest opportunity a man could ask for? If you'd put that youthful drive and hustle, that good education and quick mind to work in your Dad's shop, there's no limit to what you could accomplish.

The electrical business is a good business, an honorable business, Joe. Your Dad is a successful, respected business man, more important in his community than you probably realize. That's what he has accomplished in the electrical business — and you can accomplish even more. He wants you to — he'll help you.

Of course, electrical repair and construction is hard work. You'll sweat and get dirty, but you're used to that, aren't you? You're no dude or sissy. 'However, you'll have the satisfaction of knowing you're doing important, essential work — work that requires skill and brains. You'll be better paid than nine out of ten white collar workers, and you'll be independent.

Think it over when you have time, won't you, Joe? Remember, your Dad needs you. And, whether you know it or not, you need him, too, just as much as you did when you were a barefoot kid with a broken wagon.

Remember that story about the acres of diamonds? There are acres of diamonds waiting for you when you get back — right in your Dad's electrical shop.

Sincerely yours,

Sales Mgr., Electrical Div.

H. B. SHERMAN MFG. COMPANY Battle Creek, Michigan

Would you like to have a reprint of the above letter? Upon request we will gladly send reprints without cost, to you or to your son. Be sure to give us full address, to which you want reprint sent.

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PANTHER & DRAGON FRICTION TAPES

BLACKER

Sold through recognized independent wholesalers

HAZARD INSULATED WIRE WORKS

Division of The Okonite Company

Wilkes-Barre, Pennsylvania



Electrical Contracting, April 1945

43

RUBBER DRAGO

TO RESIST

Electronic bombardment of high voltage cable oil under vacuum at 10,000 volts, a test as unique as it is purposeful, is but one indication of the searching investigations here undertaken.

VOLTAGE ...

Here, wire and cable Research tests every component beyond the severest demands of service-in-the-field.

Looking far beyond today's needs, General Cable Research is prepared for the days when there will be commercial application of voltages beyond those of yesterday and today. Research endeavor is exploring in many directions, examining many products, evaluating the stability of many materials under the severest conceivable conditions. When the demand can be met, General Cable high voltage wires and cables will be available.

GENERAL CABLE CORPORATION

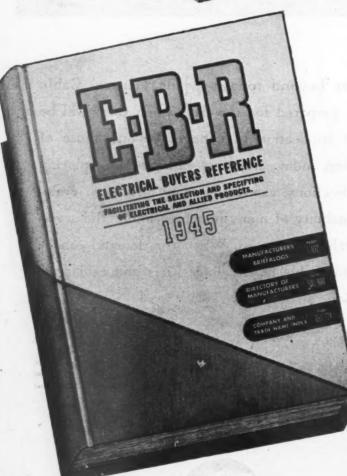


Manufacturers of Bare and Insulated Wires and Cables
for Every Electrical Purpose



... Your Efficient Servant





*Briefalog – E-B-R's own original version of modern condensed cataloging.

E-B-R is published for just one reason — to help you in your daily work of selecting the electrical products you need. It is the only reference published in, and for the electrical industry.

It is not just a collection of manufacturers catalogs or Briefalogs* — bound together. It is not just a directory of electrical products and their manufacturers. It is not just an index of trade names, and company names and addresses. It is all of these combined. And here is the way to use it for maximum efficiency:

Do you know the name of the manufacturer whose product you want to order?

Then look first in the manufacturer's Briefalog Index, pages 4 to 6, or in the Company and Trade Name Index, pages 693 to 724.

Do you know what product you want, but not the name of the manufacturer?

Then look first in the Directory of Manufacturers which stars on page 535. You will find all known manufacturers listed under the product heading. (Note that all products are indexed under the noun or principal word.)

When you locate the correct group of manufacturers, always refer next to the product data of those with boldfaced listings—and you will promptly get further buying data.

Do you know the trade name, but not the Company name?

Then look first in the Company and Trade Name Index, starting on page 693.

If you do not find what you want, write us and we will try to send you the desired information.

Every effort is made to have E-B-R complete and up-to-date at the time it goes to press. Naturally, in the year that passes between one issue and another, new products are announced new manufacturers enter the field, old manufacturers bring out new lines. All this is entered in our files, so we probably an find exactly the data you want. This is a service we are glad to render.

YOU CAN BE A BIG HELP TO US. TOO.

If you see ways in which E-B-R can be made still more useful to you, please write us your suggestions. We will welcome them.

If you have any thoughts on ways in which certain manufacturers could improve the presentation of their catalog data, tell us that too—and we will try to improve their copy in the next edition.

In short, help us to help you.



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Electrical Contracting, April 1945

WESTINGHOUSE COMMERCIAL FLUORESCENT LUMINAIRES

EASY TO

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You'll never find more versatile lighting units than the new Westinghouse Fluorescent Commercial Luminaires. Each model in the entire, complete line can be stem or ceiling mounted — hung singly or continuously. What's more, each unit requires a minimum of time for mounting — with fewer holes to drill, less hangers or fixtures to install, and line leads made accessible by loosening one screw.

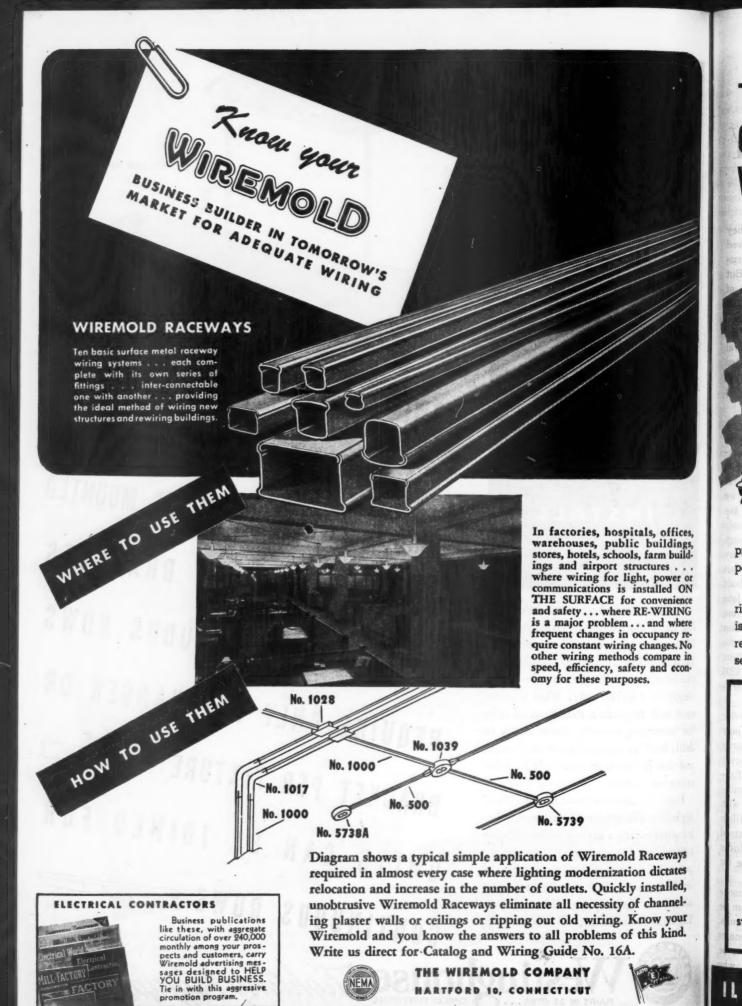
Easy and flexible mounting of Westinghouse Fluorescent Commercial Luminaires means a savings in installation cost—less disturbance or time-out for personnel in relighting your office or drafting room. Full details are available from your nearest Westinghouse Lighting Distributor.

TWIN STEM HANGERS REQUIRE ONLY ONE POINT OF SUPPORT SINGLE UNITS ARE CEILING MOUNTED WITH TWO SIMPLE BRACKETS CONTINUOUS ROWS REQUIRE ONLY ONE HANGER OR BRACKET PER FIXTURE BE UNITS CAN CONTINUOUS ROWS

LW-160 UNIT



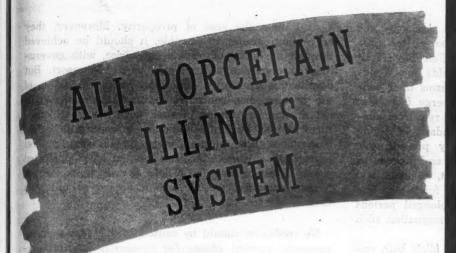
Westinghouse Lighting Equipment



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Electric

THE answer TO MODERN. COMPLETE, DEPENDABLE WIRING ANYWHERE ...



Do outstanding, adequate, and modern wiring jobs with ILLINOIS completely insulated all Porcelain Wiring Systems. Use this system for residential or farm wiring and where dampness and fire hazards are prevalent, such as in warehouses, ice plants, cold storage and packing plants, dairies, chemical works, and breweries.

Porcelain does not rust or corrode. It is a logical wiring material because it conserves steel, zinc, copper, rubber. Grounding is unnecessary when you use this system. Clamps are not required for porcelain boxes. When you sell your next wiring, sell an ALL Porcelain ILLINOIS System.

• Use ILLINOIS Porcelain for those outdoor wiring jobs.

Unfailing performance is built in every ILLINOIS insulator. Each step in their process of manufacture is closely controlled. Modern facilities and rigid inspections take all the guesswork out of their production. That is why contractors from coast to coast have made ILLINOIS Insulators standard equipment.



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OUTLET BOXES





Glazed and unglazed styles conforming to all existing standards of dimensions, spacing, position of knockout holes, and mounting screws, High mechanical and electrical efficiency.

STANDARD TUBES

In sizes 1/2 to 48 inches long, 5/16 to 3 inch diameter in following types; unglazed, glazed, split, floor, split floor, headless, curved end, crossover split, and crossover. Diameters all uniform both inside and outside.



Insure greater safety in wiring and the elimina-tion of all grounding hezards. Made of the best quality of white porcelain. Metal Inserts are placed in two holes of the switch boxes for receiving screws of standard switches, plug outlets, etc. Knockouts for single wires, also for cables. Specify and use them.





Ce ment coated—extra length nail—genuine leather was her—code standard. They don't chip when driven in and they do stay in place and have a firm grip. Available in a wide variety of heights, diameters, holes, and grooves.

ILLINOIS ELECTRIC PORCELAIN COMPANY Macomb, Illinois

AMERICA WANTS PROSPERITY

A BOOK to be published early in April by the McGraw-Hill Book Company carries the provocative title "Prosperity: We Can Have It If We Want It." Its authors, Messrs. Shields and Woodward, state in vigorously challenging terms their conviction that the United States will emerge from war with human, material and technological resources adequate to provide a nation-wide standard of living unprecedented in world history. They present, too, their formulation of the several policies and procedures which must be followed by government, business, and labor if we are to realize our potential for a high and sustained prosperity unmarred by prolonged periods of severe unemployment and business stagnation such as have haunted our economic past.

The specific proposals set forth will elicit both enthusiastic acclaim and acrid dissent, for the book deals in far from gentle fashion with many of the currently fashionable panaceas for assuring prosperity by magic formula. It examines, and discards as effective guarantors of prosperity, whatever their individual merits upon other grounds, programs for public works, slum clearance, subsidizing of small business, foreign loans, social insurance, deficit government spending, redistribution of income, the numerous formulae for monetary management, repeal of the anti-trust laws, or any of the loosely-phrased admonitions that government should do nothing and allow everything to take its course untrammeled by controls of any kind.

On the positive side, the book urges clear recognition of the fact that prosperity, under a system of business enterprise, depends primarily upon the existence of competitive incentives that spur capital investment to provide better tools and equipment, that improve organization and technology to insure continuously increasing productivity per man-hour of work, and that enlarge markets by producing what the consumer wants at lower prices to the end that real incomes may be increased.

In short, prosperity depends upon profitable and expanding business and employment opportunity, so it becomes the part of enlightened government, business, agriculture and labor policy to promote those measures which will forward rather than retard the major aim of expanding production.

However great the room for dissent upon the adequacy, or the phrasing, of the specific recommendations it makes, the approach of this book has one virtue of solid merit. It attacks positively the problem of what steps should be taken to achieve and hold prosperity rather than merely devising a poultice to be applied when and if we run into a decline.

Virtually all responsible spokesmen for government, and for business, labor, and agricultural groups, are agreed upon the goal of prosperity. Moreover, they agree that, insofar as possible, it should be achieved through the effort of private enterprise, with government intervention utilized only as a last resort. But despite this unanimity, almost all public discussion of the problem has concentrated upon the nature, the extent, and the timing of such government expenditures as may be found necessary to combat deflation. Since upon this question there is far from general agreement, our procedure has created an exaggerated sense of divergence in a field in which, so far as fundamentals go, we all are in accord to quite an unusual degree.

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No confusion should be caused by the fact that the generally current phrase for prosperity is "full employment." The latter phrase merely states the goal in terms of human values, which are good terms in which to state any goal. What matters is that we generally are agreed as to what we mean when we say that we want prosperity or full employment. Not only do we know what we mean, but within very rough limits we can give dimension to our concepts. There are a few whose appraisals are somewhat lower, but most competent estimators set the goals for about 1950 at an average annual employment in civilian jobs of between 55 and 57 million persons, with a gross national product of between \$185 and \$200 billion measured at 1943 price levels. This contrasts with the 1944 level of non-military employed of 511/2 million, and a gross output for the end of 1944 of over \$200 billion. It assumes a reduction of the average workweek to 40 hours.

It will take some such levels as these to provide employment for those who seek work, with only sufficient "frictional" unemployment (those temporarily listed as unemployed because of the normal turnover between jobs) to afford reasonable labor-market flexibility to both workers and employers. The non-military employment figures are generally consistent with the officially stated postwar goal of jobs for 60 million workers, since the latter figure is generally understood to be an estimate of the labor force, which includes members of the armed services and an allowance for frictional unemployment.

There are a number of reasons why the estimates cannot be figured more closely, and why no one can be very confident even of the validity of the stated limits. The chief points of doubt in the employment estimates relate to how many withdrawals there are likely to be on the part of women, oldsters, and youngsters, who now are in the labor force to a number more than 6 millions beyond normal expectancy; how many men will be retained in the armed forces; and whether the

postwar frictional unemployment should be calculated as approximating the current 1 million or the 3 million so-listed in the prosperous year of 1929. Additional uncertainties cloud the estimates of gross national product. Notable among them is the fact that no one is sire of the war's effect upon man-hour productivity trends, in view of the fact that half of our current output has consisted of products that had no substantial counterpart in our peacetime price or production series.

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Nevertheless, despite such qualifications, it is fair to say that we do have a general conception of the magnitude of our postwar goals. Although they are well within our production potentials as demonstrated in this war, they are formidably beyond any previous record of peacetime achievement. Only the most sanguine optimism could lead one to expect that they will be achieved without concerted will, planning, and cooperative effort. Only blind recklessness could engender confidence that once attained they will automatically be held, let alone expanded in normally healthful growth.

If we were to follow past patterns, our war-built boom would, after a period of uncertain length, collapse into disastrous depression. The very magnitude of our recent growth would contribute to the depth and duration of the subsequent trough. Yet a fall even to the level of our previous peacetime-peak-year 1939, has been estimated by The Federal Reserve Board to imply unemployment for between 15 and 20 million persons. If human values have importance, that is something that must not be allowed to occur. If business values have importance, we must not tolerate again such losses as occurred from 1930 to 1933, when sales over the four year period were \$128 billion less than would have been provided if the 1929 level had held, and corporate profits declined from more than \$7 billions in 1929 to an average annual loss of \$1 billion over the next four years. A repetition of these things cannot be tolerated-if foresight and cooperative effort can prevent them.

* * *

In January of this year Senator Murray introduced in the Senate a bill entitled "The Full Employment Act of 1945." It instructs the President to submit to Congress plans for eliminating both unemployment and inflation, including recommendations for correcting structural defects in the economic system. It provides for a Joint Congressional Committee to consider the proposals of the President, to take testimony from experts and the general public on these proposals or any others it may wish to consider, and after weighing all the facts to submit its findings to Congress. It provides for an advance budgeting of the constituent parts of a full-employment economy, and commits the Federal Government to provide, in advance, for sufficient expenditures (through private contractor channels) to make up for the gap between estimated private expenditures and the amount necessary to assure full employment.

By no stretch of the imagination can The Full Employment Bill, in its present form, be regarded as acceptable to business. Yet it may well present a test of whether or not American business can deal with problems in this area in a statesmanlike fashion. Such statesmanship will consist in demonstrating first, that the Bill is not acceptable because of deficiencies which preclude the possibility of its accomplishing the avowed purposes; and second, that business is able and anxious to offer constructive suggestions for remedying these deficiencies.

It is easy to point to weaknesses in the Bill. To mention only a few of major importance: The proposal to make advance Federal expenditures to compensate for estimated deficiencies in prospective private expenditures is completely impracticable. No one in the country can predict future trends with sufficient accuracy for this purpose; no one can tell what the constituent parts of a really high, stable peacetime budget should be, for in our boom-or-bust economy we have no stable pattern to project; no one can tell, within reasonable limits, how much the government should spend in advance to assure full employment. The Bill pronounces labor's right to work without defining commensurate responsibilities which it should exercise. It does not define the areas of proposed government expenditure in such a way as to allay business fears of government competition or the general public suspicion of leaf raking. Above all, the Murray Bill is defective in that, despite a somewhat vague pronouncement in favor of forwarding private business activity, it recommends a single specific designed to supplement such activity rather than stimulate it.

The very definition of certain of these faults suggests their remedies. But the positive task of stating how the Bill should be amended in order that it may have effective usefulness is far from simple. Yet it is enormously to the advantage of American business to undertake it. Fortunately, there is a representative group sponsored by industry, The Committee for Economic Development, which has for some time been working intensively upon the problem, and which is excellently equipped to offer sound and progressive advice. It should be used for this purpose.

American business cannot afford to take a negative attitude toward legislation in this field. Some legislation undoubtedly will pass, for the problem is one in which there is a grave government responsibility. But equally there is a comparably important responsibility upon all citizen groups. None of them has more to gain or lose from the rise or fall of prosperity than American business.

Show H. W. haw. fr.

President, McGraw-Hill Publishing Co., Inc.



Centralized Radio entertains guests in their rooms, sells "extra" hotel services through spot announcements, provides means of issuing emergency instructions in case of fire or accident... Paging Facilities locate guests efficiently, without delay... Selected Programs of your own choosing may be sent to dining room, restaurant, lobby or other parts of the building... Sound Reinforcing in public rooms makes speeches or entertainment available to larger audiences... Intercommunication Facilities place manager and staff

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RCA Sound Systems, Centralized Radio and Intercommunication Facilities—for every hotel need. Design sound into your plans for new or remodeled structures. If you need assistance with your project, write Department 70-137X, Sound Equipment Section, Radio Corporation of America, Camden, New Jersey. An RCA Sound Specialist is at your service.

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Speakers — wallcabinet and flushmounted type for inside use; hornbaffle type for outdoor use.





Microphones — dynamic and velocity types in either table or floor-standmountings.

Intercom units—for intercommunication between key persons and operating departments.



BUY WAR BONDS

APRIL . . . at a Glance

IS THE ANNUAL WAGE practical from the standpoint of good business management? In January, Marion Hedges of IBEW presented labor's case. We asked industry leaders to comment for management. This month on page 60 you will find their answers, "What They Say About The Annual Wage". It is thought provoking stuff. This old industry has come a long way in labor relations. The comments of these men are extraordinary for their keen insight and clear understanding of labor's viewpoint as well as their own.

GUS ECKEL'S ARTICLE on the installation at Allison ("Flexibility Plus", page 57), contains a wealth of ideas that can be applied to many industrial jobs. Bus systems are inherently flexible. Their usefulness, however, can be extended still further with plug-in capacitors and rectifiers. The lighting system, too, includes some unusual distribution methods.

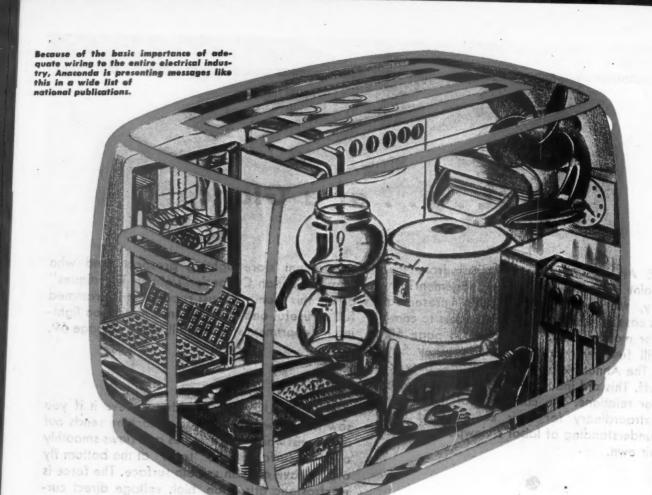
TRACTION MOTORS get tough service in these times. They create maintenance problems that can only be met with specialized shop equipment and smart scheduling. Bob Miller's story about the shops of the New York subway, "Traction Motor Maintenance", page 64, is straight down the alley for everyone concerned with motor maintenance and repair.

SOFT PEDAL ON POSTWAR talk is still the rule. But there are plans being drawn where sound lighting advice is needed now. If you have a department store lighting prospect (and who hasn't?), Berlon Cooper's "Lighting Techniques" article this month is must reading. It is crammed full of useful and practical information on lighting a department store. You'll find it on page 69.

MIRACLE STUFF, you wouldn't believe it if you saw it. A new spray-painting machine sends out a fine mist which concentrates and flows smoothly over the surface, Paint "tears" at the bottom fly off to leave a clean smooth surface. The force is electrostatic attraction, high voltage direct current provides the charge. Here is a new field for electrical apparatus of particular interest to those concerned with industrial problems. See "Painting Without Tears" on page 72.

WHEN SPEED IN DRYING is wanted, it is becoming almost conventional for industrial electrical men to turn to the infra-red process. At North American Aircraft paint drying was speeded and bottlenecks broken with banks of infra-red lamps. See page 76.

FAULT CURRENTS used to be a highfalutin problem that was pretty much the exclusive worry of utility men. Modern industrial wiring today, however, includes large conductors, heavy currents and a new appreciation of the importance of interrupting capacity in breakers and fuses. A series of articles on how to calculate interrupting capacity begins in this issue in the Industrial Electrification department.



Your electrical future won't stop at a Toaster-

Don't Risk Postwar MIRE-1115



Now – while you are planning your electrified kitchen – watch out for that coming

clectrical ill, Wire-itis.

Plan your wiring for full, efficient operation of not just a few, but all needed appliances—refrigerator, range, dishwasher, garbage disposer, exhaust fan, and a dozen others. And don't forget ample wiring service for other major improvements, such as air-conditioning, advanced heating, laundry devices, television.

Your electrical contractor knows postwar Wire-itis is likely to be costly in expensive alterations. Don't delay—make a point of it to go over your plans with this authority nowl

Manufacturers! Your electrical plans too may foretell postwar Wire-itis. Before they get out of the blueprint stage talk with your consulting or plant power engineer, electrical contractor or power salesman.

Remember – foresighted wiring will be far cheaper than the "wait and see" kind.



* Failure of wiring to meet expanded peacetime needs

ANACONDA WIRE & CABLE COMPANY

GENERAL OFFICES: 25 Broadway, New York City 4

Subsidiary of Anaconda Copper Mining Company

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CHICAGO OFFICE: 20 North Wacker Drive 6 • Sales Offices in Principal Cities

V Check Your Wiring Plans Before They Check You!

TOO BUSY TO SELL

Contractors aren't salesmen. Every time you collect more than four electrical industry people into one room, someone will contribute that standard observation. It has been repeated often. It stands neither challenged nor supported. It has become an axiom. And nobody cares.

Let's call on a leading contractor. Maybe he has something to say on the subject. He has just come in from Jim Blank's office. Jim is an architect. "Had to get Jim straightened out on a lighting job," he says, "nowhere near enough feeder or circuit capacity for what he wanted in light. We'll have to double the panelboard order alone." "Mr. Sparks," we ask, "are you a salesman?" "No!" he says, "the way we are set up I don't have time to do much selling!"

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Let's try Charlie Brown. He has a nice line of industrial work around town. "Charlie, do you sell any electronic apparatus?" we ask hopefully. "No," he replies rather thoughtfully, "not up to now. But it is certainly a field we want to work in a big way one of these days, great stuff, these electrons." After a while, just as we reach for our hats, he says, "Just finished a swell job you fellows ought to see before you go-over at Smith Mills. They needed a lot of d-c. We put in two banks of rectifiersignitrons, you know. Some of the neatest bus work you will see around these parts."

No point in quitting yet. Let's try Ollie Jones. He does strictly small work, but smart. He has got to be a salesman. "Ollie, you must have to do a strong selling

Alectrical Contraction April 1945

job to keep up this place," we say. "No," he says, "we stick pretty much to straight service work here. I line up contracts with sales organizations, oil burner people, refrigeration outfits and the like. Of course, we run into a lot of repair work and small jobs along the way. We are pretty well known around town for quality work and reliability. Wish we could do a real selling job, but right now we just don't have the time."

TROOF SERTORS

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After you have been rocked back on your heels by a dozen such experiences, you get the idea. The contractor is not a salesman. He says so himself. He is too busy. He has to develop markets, satisfy customers, install great power and lighting systems, and shoot electrical troubles. He hasn't the time nor the manpower to sell the conduit, wire, panels, switches, fuses, fixtures, wiring devices or kilowatt hours that everybody wants him to.

Anecdotes they are, garbled to conceal the source and maybe make them cute. But they are true to fact. And they are true in accurately representing the attitude of electrical contractors toward "salesmanship." They admit they are not salesmen. They are just too busy doing one of the greatest and most creative market development operations in the entire electrical industry. And it's a full-time job. Here is another place where John Wern, the

לוניתוב הסובנים, כנו גב הו

Wm. J. Stuart

Electrical Contracting

APRIL, 1945

ANOTHER BOOST for your service to builders

Here's the latest in the series of Graybar advertisements addressed to architects and builders through the pages of The Architectural Forum. These advertisements are helping to give 40,000 leaders in the building field a better appreciation of your qualifications and services. They back up Graybar's belief that a more important role than ever lies ahead of the well qualified electrical contractor.

John Watts
Electrical Contractor

has a drawer-full, too!



Important innovations in building construction are on the way. Already your files may be bulging with data on promised new products and new plans for using them.

On the electrical side alone, there are enough postwar developments now in the news to make the evaluation job burdensome for anyone but an electrical specialist.

Here is another place where John Watts, the local electrical contractor, can be of real help to you. He

can help evaluate new products or ideas in the light of his on-the-spot knowledge of regional codes, powersupply, working conditions. He'll be glad to work with you on plans for applying new electrical ideas to industrial, commercial, or residential buildings, even though the project may be tentative.

Well-informed electrical contractors — the John Watts' all over the nation — do their electrical buying via GRAYBAR. You can depend on them for sound, first-quality electrical supplies.

Give Your Electrical Work to "John Weste" a qualified electrical contractor — heading a well-established firm with the trained organization, tools, and know-how to give you specialized assistance on wiring, lighting, signaling, power apparatus. From offices and warehouses in over 80 cities, GRAYBAR serves a nation of JOHN WATTS', helping them to help you by supplying the newest and best in electrical materials.



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Flexibility PLUS

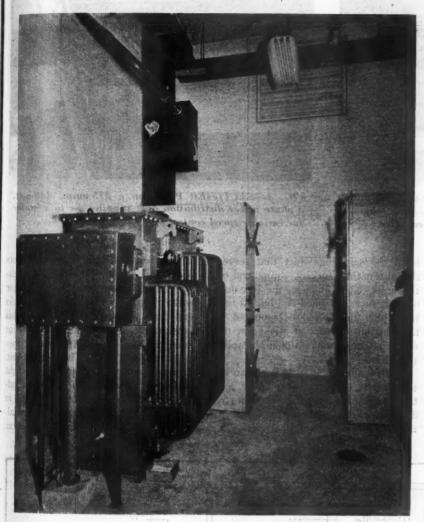


FIG. 1—TYPICAL UNIT SUBSTATION showing transformer and cubicle equipment. Power unit (1000 kva.) is at left; lighting unit (300 kva.) is at right. Feeder bus ducts leave from top of cubicles.

SEVERAL novel engineering features project the electrical distribution system at General Motors Corporation's Allison Division Plant No. 5, Indianapolis, Ind., above the level of conventional bus duct installations. Incorporating spot conversion of alternating current, individual feeder power factor correction, "isolation points" for emergency circuit tie-in and a flexible lighting installation, these features provide what might be termed unlimited flexibility to an already highly flexible electrical system.

The plant was designed and built some years ago to produce the Allison aircraft engine for the armed services. The plant engineering department realized the necessity for quickly shift-

ing or changing an entire production department to meet the demands of possible design and production changes dictated by the fluctuating requirements of an all-out war. They sought and—through the engineering acumen of plant electrical engineer W. O. Margrove—achieved that added degree of flexibility that now makes department changes a simple chore from the electrical standpoint.

The basic distribution design incorporates a conventional bus duct system. Incoming 33 kv. power is stepped down at the power house to a primary distribution voltage of 4160-volts. From the power house switchgear, these feeders serve vault-enclosed unit substations (Fig. 1) strategically lo-

Specially engineered features extend the flexibility of a conventional bus distribution system at General Motors Corp. Allison Division plant in Indianapolis.

By August Eckel

and such machines non to be shifted the

cated throughout the plant area. Secondary bus duct distribution emanates from these unit substations at 480-volt, 3-phase for power and 120/208-volt, 3-phase 4-wire for lighting. Some 5,500 feet of 1500-amp., 440-v., 3-phase feeder duct and 35,000 feet of 375-amp., 440-v., 3-phase, distribution plug-in type bus duct serve the power requirements of the entire plant area. Bus-plugs with multi-conductor cable drops feed individual machines.

Not to be thwarted by shortages of equipment, the engineering department devised means of securing power feeder duct not available in the 1500-amp. size at that time. They simply had the manufacturer mount two sections of 750 amp. bus duct back-to-back with the necessary minor alterations to provide the required capacity (see accompanying Fig. 2).

Rectifier Plugs

One of the outstanding "flexibility" features of Allison's electrical system is the spot conversion of alternating current to direct current to serve the needs of individual machine tools. Dual distribution systems are practically eliminated.

From the power house switchgear, Direct current distribution—specithese feeders serve vault-enclosed unit fically to scattered machine tools resubstations (Fig. 1) strategically loquiring such power—was one of the

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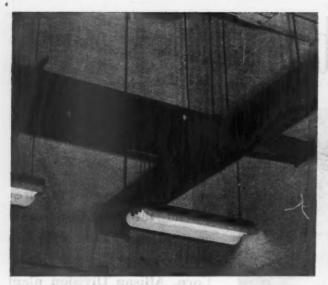


FIG. 2—POWER FEEDER DUCT leaves unit substation vault. Note construction of two 750-amp. ducts mounted back-to-back to provide the 1500-amp. capacity.

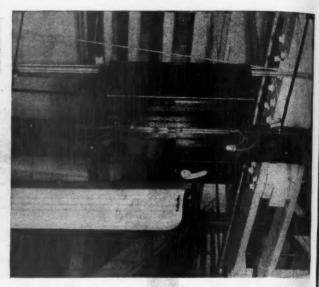


FIG. 3—RECTIFIER PLUG on a 375-amp., 440-volt, 3-phase power distribution duct supplies d-c to a motor for variable speed control on a Cincinnati Grinder.

salient economic problems encountered. It would be sound engineering practice to extend d-c lines to those machines from a motor-generator set. But, if and when a department was changed and such machines had to be shifted the d-c lines would also have to be relocated—a chore requiring considerable time. There must be some means of achieving a flexible design which would overcome this objection.

The solution was spot conversion of the individual machines

from the same bus duct that served the alternating current equipment on the units. Upon request, the bus duct manufacturer designed and built a rectifier plug that could be mounted to the distribution duct at any point the same as any conventional bus-plug (see Fig. 3).

The rectifier plug includes as an integral part of the unit: plug-in contact fingers (fit into the bus duct); a 3-pole, 440-volt, pull-out, fused disconnect; 115-volt control circuit with

transformer, contactor and remote puslabutton; a 440-v./110/220-v. transformer with tap panel or selector switch, copper oxide rectifier stacks connected to the secondary of this transformer, and terminal block for connection to d-c motor control (see diagram—Fig. 4). This equipment, designed to provide either four or eight amperes of direct current at the secondary voltages mentioned, is enclosed in a metal case equipped with a metal-grille bottom for adequate ventilation.

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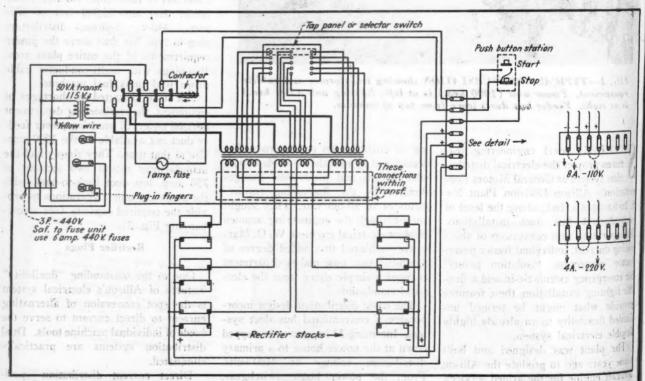
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internal connections of this "spot conversion" unit.

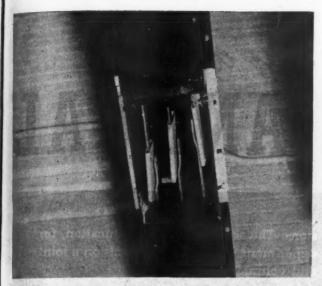


FIG. 5—SECONDARY DISTRIBUTION SYSTEM with "isolation points" installed on 250-foot centers in the feeder bus ducts and power distribution ducts.

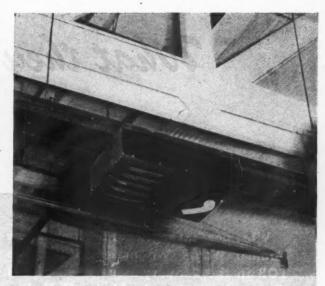


FIG. 6—CAPACITOR PLUG provides power factor correction on individual power feeders. Unit incorporates a 15 kva. capacitor and fused disconnect switch.

Employed to provide small amounts of direct current to isolated machine tools such as grinders, magnetic chucks and others requiring d-c for variable speed control, these units can follow a machine tool wherever it may be shifted in the plant. Moving the rectifier plug merely involves opening the fused pull-out switch, removing a few bolts securing the case to the bus duct and lifting the unit from the duct.

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Motor-generator sets and d-c feeders are installed in areas where a large number of machine tools requiring d-c service are in close proximity to each other and where considerable d-c load is required.

Isolation Points

Good engineering practice dictates designs permitting interconnection of substation secondaries to provide continuous power service should one of the substation units "go out;" also sectionalization of distribution feeders to prevent an entire production line from stopping due to a feeder outage. At Allison, such emergency interconnections are provided by simple, inexpensive "isolation points" located at approximately 250-foot intervals along each line of power and lighting feeder duct and each run of power distribution duct in the plant (Fig. 5).

These "isolation points" are merely breaks in the busbar continuity at normal junctions of the continuous bus duct installation. At the designated junctions—clearly identified by having the bus enclosure at this point painted a bright yellow color—the busbars are left unbolted and are equipped with

heavy fibre insulating sleeves. If an emergency should arise, a tie-in between the two bus duct sections can be quickly made by simply opening the enclosing screw-cover, removing the insulating sleeves and bolting the bus bars together. Emergency connection may not be accomplished as quickly as with unfused switches at these points, but undoubtedly it is just as fool-proof and certainly more economical from the standpoint of saving critical materials and cost—when you consider there are more than 150 such points in the entire electrical system (based

on one for each 250 feet of duct).

Power factor correction—another important feature of any industrial power distribution system—is provided on individual distribution feeders at the Allison plant. Again flexibility was a prime consideration and led to the selection of capacitor-plugs as the corrective equipment. These units, incorporating a 15 kva. capacitor and a fusible disconnect switch, are mounted to the distribution duct in the same manner as an ordinary plug-in unit (Fig. 6). In a few minutes time they can

[Continued on page 201]

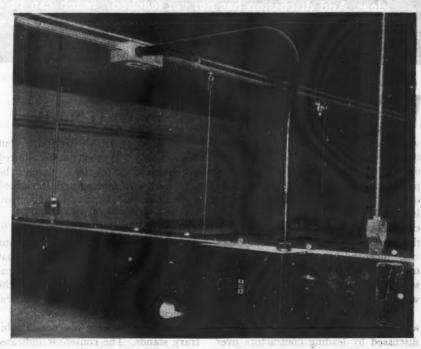


FIG. 7—DUAL DISCONNECT on lighting feeder duct serves two Trol-E-induct circuits at a sectionalized feed-in coupling. Lighting load is carefully balanced on the 3-phase, A-wire system.

What they say about ANNUAL

What does management think about the Annual Wage? We presented the case FOR in the January issue of Electrical Contracting, written by Marion H. Hedges of the IBEW. And then we asked leaders among the contractors, and other influential electrical groups, for their comments.

And out of the earnest, sincere and searching analysis that marked practically every one of these comments, come a host of new perspectives on a great and complex problem.

Most challenging of all was the wide range of opinion. There is forthright support of the annual wage principle. There is clear condemnation of it as unworkable. It is plainly evident that opinion generally is in a state of flux, unhampered by fixed ideas. And discussion has not yet reached a wide enough forum to jell into set deci-

sions. The way is open for education, for experiment, for seeking out facts on a joint and voluntary basis.

Here is an opportunity, almost unique in the history of our industry's labor relations. A far reaching proposal of tremendous economic significance is being approached with sincerity, reason, and moderation. The committee work, discussions, forums, experiments and studies that will go on during the coming years may well set a wholly new pattern for labor relations.

The annual wage offers opportunities to management in approaching new areas of market development. It offers new opportunities to labor in stabilization and security. Yet there is no urgency for quick, broad scale decisions. It is a field where much can be accomplished through joint research and voluntary experiment.

WAGE stabilization on an annual basis is both possible and practical within conservative and sound business rules, if it is applied to those areas of business activity where markets are stable. Maintenance, repairs, in-plant industrial work and other activities which are subject to independent sales efforts can be included. Construction work wherein the electrical contractor cannot exercise independent and direct control over market development or job schedules is not yet within the area of wage stabilization.

That, briefly, is the nub of the annual wage problem as outlined and discussed by leading contractors over the country.

The annual wage in general is a long term development, they say, which

By W. T. Stuart

must be approached cautiously but courageously. It must not be allowed to confuse labor relations. It must be developed with sincere and farsighted joint action by labor and management. And it must benefit both.

There is always the temptation to over-simplify large issues. Few of our commentators, however, erred in that direction. Most, in fact, drew attention to one phase or another of the annual wage to emphasize the practical problems which must be solved.

Significant was the absence of arbitrary stands. The consensus indicated an open-minded attitude, skeptical but not dogmatic. "We are not categorically opposed," they say compositely,

"but we sincerely doubt that practical plans can be evolved to cover other than a small percentage of electrical workers." And this is good. For in this early stage of industry discussion, a healthy skepticism, founded in reason, can be of inestimable value. It is a rich soil for sound proposals and clear thinking. It offers no foothold for demagoguery.

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In general terms, the annual wage is a device to stabilize the income of electrical workers. Plans which have been proposed allow the mechanic to accept a weekly salary lower than a full week at the scale but more on an annual basis than he would receive in a normal year. As it is a voluntary measure, the choice of whether a man will work at the scale or on an annual basis rests with him and his employer.

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The union agreement allows but does not require such arrangements.

Proponents of the annual wage among the contractors see it as a measure to open up new business prospects from which they are now barred by high hourly rates, particularly in the fields of maintenance and repair. Opponents see it as a new wedge by labor to obtain substantial benefits without an apparent rate increase.

The following discussions are frank and considered statements of management's side of the issue.

With the exception of Mr. McChesnev's statement, the names of the correspondents have been withheld. In some instances this was done at the request of the writer, but in general it is done in fairness to many of those whose comments could not be squeezed inside the practical limitations of available space. The comments published were chosen as best representing the range and trends of industry thinking but are necessarily only a few of the important and thoughtful discussions received. The letters quoted are from men of national prominence in the industry fully qualified to speak with authority and insight.

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The most vigorous statement in support of the annual wage was that of Robert W. McChesney, president of the National Electrical Contractors Association. His analysis was one of the most searching of all. "The subject," he says, "needs to be approached with a realistic understanding of the progressive steps which must be taken to educate employers, employees and the public before it will be fully understood and made effective. Each industry must study its own characteristics to determine how, when, and to what extent full-time employment with an annual wage may be adopted for that industry.

"The electrical contracting industry consists of the business of erecting, installing, altering, repairing, servicing and maintaining electric wiring, devices, appliances and equipment, and through this

wide diversity it should be a very stable business. Actually it is very unstable because the major portion of the electrical contractor's business has been in new building construction, which requires intermittent employment of electrical workers for each job undertaken and for the duration only of that particular job, and standards of employment have been established on that basis.

Intermittent Employment

"In the building construction industry it is probable that intermittent employment on an hourly basis will be necessary for a long time to come, if not always, and because of the lost time which electrical workers suffer due to conditions beyond the employers' control will continue to have public acceptance for new building work. However, it is uneconomical to apply high intermittent hourly rates of wages to those branches of our industry where full-time employment is practical-such as reconversion, alterations, maintenance and repairs. Unless a more economical employment basis is adopted for such work, it will continue to be done in most cases outside of the electrical contracting industry. Whereas, with a reasonable wage for continuous employment the electrical contractor can do it much more economically and effi-

"If the electrical contractor is to successfully obtain a reasonable share of the tremendous volume of reconversion, alterations, maintenance and repair work that is now being done through direct employment by owners on a full-time annualincome basis, he must, himself, adopt a more stable basis of employment of his men used for that work. By paying his workers an annual income equivalent to the average earnings of the intermittent workers, he will place himself in a position to better serve industrial plants and other owners upon a more economic basis than their present methods permit, because of his more highly skilled workers, his more adequate supervision, and his definite assurance against waste and idle time in the maintenance and repair departments.

"The electrical worker, just like the electrical contractor, got his start in the building construction industry—a necessarily seasonable business which can afford employment on an intermittent basis

only. His training and thinking, naturally, have been on part-time employment with wages at an hourly rate—although for years he and his family have dreamed of full-time employment with an annual income. The hourly pay, obviously, must be at a high rate because it must include, on a reasonable average of possible working days, the worker's entire overhead—food, clothes, rent, etc.

"It is important to point out that the annual wage plan is not designed to reduce the income of electrical workers. Just the reverse is intended. Where this plan is adopted, those men who see fit to voluntarily accept employment on this basis will receive greater annual incomes than they have averaged in normal times, payable in uniform weekly amounts plus a vacation with pay and sick benefits. The contractor who employs them will, however, have a labor cost per hour that will be competitive with the hourly labor cost of industrial and other owners for the same classes of work. In other words, the industry will not be pricing for idle time for those classes of work where it is practical to attain continuous employ-

"It is my opinion that the annual wage is practical and it is a necessary element in the stabilization of the electrical contracting industry; that it will produce a high level of employment in the industry and that it will raise the standard of living of the electrical workers - all of which would contribute to the improvement of our national economy. The adoption of the annual wage in the construction industry which involves all of the building trades is not practical under existing conditions and its future application will depend upon (1) the establishment of an orderly and steady flow of construction activity, and (2) the ability of all trades to stimulate other work where full-time employment is practical."

Would You Consider It

"But let's be frank", an Eastern contractor insists, "concerning all angles of this question.

"If you received wages of \$9,000 in 1942 and 1943 and dropped to \$7759.54 in 1944, would you consider an annual salary of \$2912 in 1945 or 1946?

"The man who received \$7,759 in our organization was just an ordinary elec-

trician who displayed ability as a foreman and supervisor and had the will and desire to produce for his employer.

"One of our men received \$6.083.27. four received over \$5,000, fifteen over \$4,000, seventeen over \$3,000, eleven over \$2,000, thirty-nine over \$1,000 and the balance less than \$1,000 down to one

fellow who received \$2.

"I have had electricians in my organization who have not lost a day's pay in ten years at \$2 per hour and I do not think that \$2912 would appeal to them particularly after Social Security, Old Age and Internal Revenue Taxes reduced this to \$49.28 per week, out of which would have to come carfare, lunches, union dues and assessments as well as their personal hand tools.

"At the present time the working man is in a position where he is wary of all theoretical ideologies that are designed to better his position in life. He has been made the butt of the most confused, conflicting and demoralizing theories that have been devised by men who never climbed a pole or bent a piece of pipe in

their lives.

Employers Ability to Sell

"Steady employment or unemployment is not a question of whether an electrician is paid on an annual or hourly basis but upon the demand for that man's service and skill as created by his employer's ability to sell his product to the public."

The annual wage can be accomplished but should be attained slowly and carefully, believes a prominent New York State contractor. "It is a step in the right direction" he says, "but I do not expect to see its full attainment in my life-There are too many angles to be ironed out such as the territory, the kind of work available and prevailing rates.

"I believe that this annual wage may first be accomplished covering service, maintenance and extension work in industrial and commercial work with the service part probably applying to all classes of this work, and this application would only apply to a very small percentage of the workmen in any regular contractors organization. Perhaps the next step will be in connection with the low price housing jobs and certain residential work, in territories where the outlook is favorable for a program of this kind of work extending over several years.

"For the heavy construction job-industrial, federal, state, municipal and utility, I see no prospect of the annual wage program being adopted."

And from the South another contractor sees the annual wage as applicable to a

limited area of activity.

"Those of us who specialize in serving industrials - performing maintenance work, alterations and extensions to their structures, and in many cases handling the construction of complete new units, would find the annual wage proposition very attractive. We usually have steady

year around employment for a selected group of mechanics and foremen. anticipated volume of work usually being sufficient to warrant us guaranteeing these men full-time jobs throughout the year.

"For those others who secure their volume through competitive bidding and who specialize entirely in new construction, I doubt that it could ever be successful without labor taking a backward The hourly wage rate for construction of this sort necessarily should be higher because the employment is intermittent, and seasonal in some parts of the country."

In a careful analysis of both good and bad features of the annual wage, a Mid-west contractor concludes that "On the whole there seems to be more points against the plan than favorable to it when we consider construction work, but slightly favorable from a standpoint of

maintenance and repair work.

"I believe that something is wrong with the economic status of all construction workers. In my opinion the annual wage is not the solution. It does not go far enough-it does not provide proper compensation for the actual worth of the

average workman.

"I would like to see injected into this wage question the provision for more protection for the worker by the setting up of insurances and retirement pensions. I would like to see more income for the worker who wants to produce more. I would like to see some plan put in effect that would establish a workman's productive period at approximately 30 years, with retirement at 50 to 55."

High Degree of Sincerity

The importance of a meeting of minds is expressed by a leading Eastern con-"I am inclined", he says, "to classify the three parts of this subject as first, the sincerity of purpose; second, the acceptance, and third, the application.

"It must certainly be admitted that any proposals to establish annual wages must have a high degree of sincerity of purpose behind them if they are to be accepted and applied without prejudice by both parties to the agreement. From certain suggestions submitted to date on the subject, it leaves an element of doubt in one's mind as to the degree of sincerity or

practicality of thought.

"Most of the proposals suggested contain two reservations, whereby the employee may abrogate the agreement upon a certain fixed time notice, and furthermore, shall not be used on work associated with the higher wage levels in the industry or construction work. makes a very inflexible arrangement for the employer and does not provide him with any protection. Obviously, few employers could so set up a shop, except in a very small and modified manner, in order that annual wage employees would be confined only to maintenance work, with no permit to work on general construction, except as they may desire by

suitable written notice to cancel their contract with the employer.

"The second phase of this issue seems to surround the probability of acceptance by the employee, where all doubt or prejudice is removed from his mind as to the sincerity of such a proposal, in attempting to fortify his future and supplement Social Security assistance. This is very difficult to handle and develop, since it deals with the personal element, and in order that a reasonable degree of employer protection and employee loyalty be maintained, it must be wholly accepted by the employee without suspicion. I seriously doubt whether this is possible today, considering the national issues that have been raised between labor and management, where some doubts have been left in the minds of bith as to the sincerity of the other.

Depends on Timing

"The application of such a plan is largely dependent upon timing, and from casual observation at this moment, the timing is not opportune, since there is sufficient work at the higher wage level to keep all employees occupied without any pronounced loss of time. So long as this condition prevails, it will be utterly impossible to induce any employee to accept a guaranteed lower annual wage. It would seem, therefore, that we must wait until the employee is so minded, rather than his labor organizer or his employer.

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"I believe that such a plan may be practical at some future date when both labor and management are willing to give and take in the common interest of developing respect for each other's position and earn-

ing capacity."

"Flatly impractical", says a Midwest contractor, "due to the varying demands for labor in construction work.

"I think it might eventually be applied to maintenance and service work to a limited degree but one of the great difficulties that will be encountered will be the attitude of the individual members of the local union. By that I mean that after a contractor is able to employ on an annual basis a portion of his crew men, those not put on an annual basis will be dissatisfied. On the other hand, if these men not under an annual wage contract get in a great deal of overtime, the men on an annual wage contract will be dissatisfied. Another angle is that there are a certain number of men in every local who do not have steady employment in any one shop and as a consequence they probably would never have the opportunity of being employed on an annual basis. This would cause dissension within the local and if such men were very influential, would prevent the use of annual contracts.

"It seems to me that the matter of annual wages will first have to be definitely agreed upon in the various locals of the IBEW before the employers can even negotiate with the local unions on this matter. The employers will have a great enough problem to solve without

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having first to sell the local unions on it. I do not believe that the IBEW has as yet been able to sell the personnel of the local unions on annual wage contracts except in a very few instances. It seems to me that they will have to allow sufficient time for some locals to operate under those conditions long enough to be able to definitely show satisfactory results. Local unions invariably contact other locals who have tried new experiments to find out the result before they will agree to inaugurate such changes."

Suggest Trial Set-ups

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A favorable and thought provoking plan is outlined by a New York contractor.

"We suggest that trial set-ups for putting the annual wage idea into practice be made in localities where there are groups of contractors whose tendency is to confine themselves to work within their territories, that is, where there is a minimum amount of roaming.

"We suggest that contractors in these trial areas be asked to prepare charts running back over a period of five years, plotting their employment payrolls by weeks, from which it should be possible to arrive at a basis of minimum and maximum and average employment.

"No matter how wisely the number of annual wage employees are chosen, there would be bound to be some lack of coincidence with the actual conditions that would develop. It is suggested to cope with this situation and to avoid the fostering of boondoggling that the contractors and the union agree ahead of time on a certain reserve of work items (study or research items) to which idle men could be assigned. We all have items of this sort on our agendas, matters of study which we are always going to get to but never do.

"As experience multiplies as to the extent of this idle or research time, a fund might be established to defray such costs and thus have a tendency to make contractors a little more courageous in agreeing ahead of time as to the number of men which they would guarantee to put on the annual wage basis.

"It has also been suggested that a group of 'annual wage' contractors might create a pool of 'annual wagers' and swap the men around among themselves as work demands might dictate. 'Research work' is a rather high sounding phrase for many people and by itself it probably will not fill the gap, but needs to be implemented by an actual specific program."

An annual wage plan was attempted in Philadelphia. A contractor there sees the local union attitude as unfavorable.

"There is one point with which I do not agree, however, and that is the statement that 'Labor likes the annual wage.' Because the conditions were felt to be more nearly right, it was suggested that the first attempt to establish an annual wage be made in the Philadelphia area. It was found, however, that the administration of the local union was not favorable.

"On the other hand, management is only lukewarm. There is no great tendency to quarrel with the present rates, but if the contractor can secure a lower hourly labor cost in exchange for a guarantee of one year's security for the worker, I feel confident that such an arrangement would be embraced by at least a representative number of local contractors.

"I do not think the annual wage is a solution to all of the problems of the contracting industry, but I do believe it would tend to stabilize at least a small portion of the industry, and I believe it is not only practical but highly desirable in the interest of recapturing and retaining in the future a class of work which cannot now be obtained and profitably performed by the IBEW employer.

HIGHLIGHTS



For the Annual Wage . . . Against



High intermittent rates are uneconomical where full time employment is practical.

Full time employment rate allows competition in fields now difficult to serve at high scales.

Stability of employment and regular wage fosters interest, loyalty and efficiency among workers.

Annual wage is immediately applicable to service and maintenance work on a voluntary basis.

Would develop better management and job scheduling methods for stabilizing labor requirements.

Should be considered now while labor relations are on a highly cooperative and reasonable basis.

Men accustomed to high hourly rates will not accept lower annual salary.

Cannot contract for sales on an annual basis, therefore cannot contract for annual wages.

Annual wage will foster indifference and slow down on part of workers and reduce labor efficiency.

Fluctuation of business cycle makes annual wage too risky for sound business judgment in normal times.

Would confuse and complicate competitive bidding and promote chaotic chiseling among contractors.

Wrong time for consideration because there is full time employment at high hourly rates.

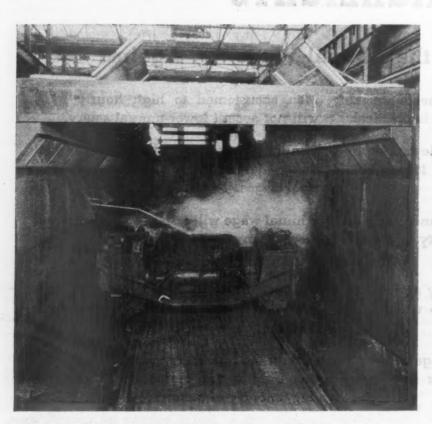
TRACTION MOTOR



A combination of scheduled replacement and wear-it-out policy is found most economical in rapid-transit maintenance.

By R. E. Miller

BERNHARD F.
CORDTS, Engineer of
Cars and Shops. His
maintenance philosophy includes an abhorrence of "polishing
brass". His "wear-itout" policy applies to
electrical equipment as
well as mechanical
parts of the cars.



AFTER TRUCKS ARE REMOVED from cars, exterior dirt and grime is removed by high pressure steam and water jets. Ventilating openings of motors are covered with tarpaulins to protect windings and commutator. Motor is then removed from the truck and delivered to the motor shop.

AFETY, integrity of service, and cost are the three principal fac-U tors used to determine maintenance procedure for the New York City Transit System. Bernhard F. Cordts, Engineer of Cars and Shops avoids "polishing brass" by adopting a combination of the two schools of thought on maintenance-preventive maintenance involving scheduled disassembly, inspection and replacement; and the "run it til it wears out" theory. Cordts can back up his arguments against too much "brass polishing" with facts and figures based on his twelve years experience with the IND. Division of the New York City Transit System. His particular problems, however, are simplified to an extent by conditions peculiar only to subway operation. For instance, cars operate in multiple units and should trouble develop on a single car, the trip can generally be completed to the terminal without delay, without danger to passengers, and without the public ever knowing that trouble has been encountered. Also, equipments have been thoroughly standardized, permitting complete interchangeability of all parts. Thus, any motor, or armature or control, cable, pinion, gear, etc., can be installed on any of the 1700 cars

Each car is driven by two 190 horsepower four pole series motors. The operating voltage is 600 volts d-c. Approximately 3450 of these motors require attention with an average of nine motors turned out by the shop per day.

Two Classifications

Motor shop operation is broken down into two classifications—the first, a two-year inspection and renova-

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PINION IS FIRST REMOVED from tapered shaft. Lip on split-coupling catches back of pinion while groove engages collar of jack-screw adapter. Nut on adapter fits into socket-head of air driven impact hammer. Only two to three seconds are then required for removal.



MOTORS ARE THEN TIPPED on end and armatures pulled. Note fitting on shaft which engages crane hook. Shaft ends were drilled and tapped for attachment to fitting with three half-inch cap screws. In this way, handling the heavy armatures is greatly facilitated.

tion; and the second, a six-year complete overhaul. Thus, in a six-year period, each motor receives two twoyear overhauls and one complete sixyear overhaul.

Each individual car is shopped once a year for cleaning and repacking bearings. As a rule, no disassembly work is done. Trucks and motors are given a thorough air-blow, and bearings are flushed and repacked with clean waste. A few other mechanical inspections for wear are made at this time where experience has shown it advisable.

The most important factor contributing to this annual shopping of cars is dust. Brake-shoe dust, steel track and wheel dust, road-bed and carbon dust are abrasive to bearing surfaces, clog ventilating ducts, short-circuit commutator bars, etc.

Two-Year Schedule

At the end of two years when a car is shopped for its second annual inspection, mechanical wear on certain parts require complete dismantling. Trucks are completely disassembled for the inspection of gears, pinions,



VENTILATING OPENINGS in the armature spider are given a thirty minute air blow. It is very important that these openings be thoroughly cleared. During operation, heat generated in the windings is carried out by air flowing through these passages. Obstruction might cause burn-out.

AFTER THREE HOURS of preheat at 225 degrees, the armatures are cooled down and dipped. Following complete impregnation in an oven-drying varnish, the armature is drained and replaced in the oven for a twelve-hour bake at 235 degrees, (Below)





BAKING OVEN CONTROLS are enclosed in a glass-paneled cabinet, Each oven compartment has its own separate controls which include a time-clock for the resistance heaters and a time-clock for the recirculating fans. A thermal control unit provides for maximum and minimum temperatures, The recorder has a dual set of pens for a continuous recording of the baking temperature in each oven compartment.

bearings, wheels, axles, etc. Since motor heads have to be pulled for bearing inspection and replacement, an excellent opportunity is afforded for quick renovation of commutator and windings. In this way, the differential in cost attributed to insulation and commutator maintenance is only a slight percentage of what it would be to completely disassemble for this purpose alone.

The shell with field poles and coils are given an air-blow, a Megger test, and a coat of air drying varnish applied by hand. A high potential test of 1200 volts is then given the field circuit.

Armature Handling

The armature is first given a 30-minute air blow to clear all the spider ventilating openings of dust and dirt, after which the shaft and commutator are checked for wear. The commutator is then hand slotted, and polished. The windings are given tests for short-circuits, opens, grounds and weak insulation by a growler test, a bar-to-bar, a lamp and a high potential (1200 volts) test. If tests indicate satisfactory condition, the motor can be assembled as soon as shafts, bearings and pinions are readied.

The six-year overhaul is much more complete and thorough. Before the motors are removed from the trucks, they are rolled through an enclosure where jets of high-pressure steam and water remove all exterior dirt and grime. The motors are then delivered to the motor shop where they are set up for pinion removal. The pinion nut is removed and the pinion hammered off. A split-coupling puller and an impact hammer do the job in about two or three seconds. A jackscrew adapter mechanically connects the puller coupling (through a collar) to the impact hammer (by a nut) and actually applies the pulling pressure through the buttress thread. The job was originally done hydraulically, but the process was too slow and laborious. So, general shop supervisor, Steve J. Raetz and motor shop foreman, Fred W. Koebrich, developed the jackscrew adapter permitting use of the impact hammer.

Motor heads are then removed and the armatures pulled and sent to the test rack. There they are meggered, and given a growler, bar-to-bar and lamp test. After the 30-minute air-blow to remove dust and dirt from windings and openings, they are pre-heated at 225 degrees for three hours. The oven doors are then opened and the arma-

tures are permitted to cool down. The insulation is impregnated by dipping in an oven-drying varnish tank, and after draining are replaced in the oven for a twelve-hour bake at 235 degrees.

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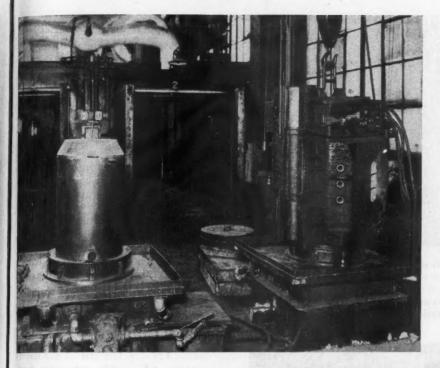
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Electric Oven

The all-electric oven is shown in several of the accompanying photos and is completely automatic. It is built with two separate baking compartments; each is equipped with its own circulating fans and ducts. Air circulation can be completely controlled from 100 percent recirculation to 100 percent circulation of fresh air. Each oven has two time clocks; one for the circulating fans and the second for oven power. In this way, heat can be turned off while the circulating fans continue to operate for a predetermined length of time. Maximum and minimum temperatures are preset by a Bristol thermal control unit and the temperature recorder has a dual set of pens for continuous recording of the heat in both ovens. Controls are enclosed in a glass paneled cabinet.

The shafts are then checked for wear and turned and polished if necessary. The commutator is checked for roundness and if out more than 0.007 or 0.008 are turned down. Otherwise they are



STATORS, IN THE MEANTIME, are meggered, air-blown and washed with jet of steam and water after which they are dried and preheated in oven at 180 degrees. Field coil insulation is then impregnated by dropping shells on these fixtures and flooding interior. Neoprene gasket seals against machined flange. Note inlet and drain holes at bottom; overflow at top. Drum merely reduces quantity of varnish required. Note two-compartment oven with ducts and blowers in background.

ON THE TWO YEAR SCHEDULE, armatures are not dipped. After the air-blow, shafts and commutators are checked for wear. Usually the commutators need only hand-slotting to remove steel and carbon dust. The face is then polished and windings tested for shorts, opens or grounds, after which a 1200 volt high potential test is applied.

only ground and undercut at this time. Windings are again tested with the addition this time of a 2000 volt high potential test.

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Stator Maintenance

In the meantime, the shell with the fields are first meggered for an indication of insulation condition. They are then given a thorough washing with a jet of steam and water after an initial short air blow. Following a thorough drying and preheat in the oven at 180 degrees, the field coil insulation is given an "Immelman" dip. Instead of dipping the entire shell, the inside is merely flooded with varnish and allowed to stand until thoroughly impregnated. This method of flooding was developed in the shop and the fixture constructed from sheet metal.

The shell is lowered onto a neoprene gasket which seals against a machined flange on the lower end of the frame. Only two small drain holes need to be plugged before flooding the entire interior with insulating varnish. The drum in the center is used merely to reduce the quantity of varnish needed



ON THE SIX-YEAR SCHEDULE, commutators usually need greater attention. They are first checked for roundness and if out more than 0.007 or 0.008, they are turned with a cutting tool; otherwise they are ground, and in either case, are then undercut. Windings are then given complete tests including a high potential of 2000 volts (after dip and bake).

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PERFECT BEARING ALIGNMENT is obtained by line reaming. Heads are bolted to shell, and boring-bar inserted. Bar is supported by outboard bearings mounted on the motor hubs. Air-screw which rotates bar is mounted on portable stand. Four cutting tools give each bearing a rough and a finish cut in one operation.



ASSEMBLY JIGS are used in putting motors together. Shell is first placed on travelling carriage and rolled back over center-tail-stock. Armature is then suspended, and shell rolled into place. Head is bolted onto frame and completely assembled motor is removed after tail-stock is released. After final adjustments, motor is ready for test.



AFTER BRUSH-RIGGING is adjusted and bearings packed and oiled, the motors are given a no-load running test at 2200 rpm. for one minute in each direction. Any abnormal bearing or commutator trouble can generally by detected and remedied at this time.

and is equipped with overflow ports. The air-drying varnish is pumped in and after saturation is drained through a valve at the bottom. Only the pole faces then need be wiped clean. A high potential test of 1800 volts is applied to the fields and leads.

Perfect Alignment of Bearings

"Line reaming" is used for turning and finishing bearings in perfect alignment. The motor heads are bolted to the shell and a boring bar inserted with a total of four cutting tools properly spaced in the bar circumference—two for rough cutting (one for each bearing), and one each for the finish cut of each bearing. The boring bar is supported by two outboard bearings mounted on the hubs of the motor heads.

The bar is driven at one end by coupling, through a universal joint, to an air drill mounted on a portable stand. The opposite end of the bar is threaded to provide automatic feed. A total of four cuts are made in the one operation. Only several minutes are required to set up and completely cut and finish two perfectly aligned bearings. To set up, the armature shaft is micrometered and the finishing tools set to 0.010 oversize. The alignment is accurate to such a degree that the big 190 horsepower armature after assembly can be easily rotated by hand.

After assembly, adjustment of brush-holders, and checking air gap, the motor is given a no-load runnning test for one minute in each direction at 2200 rpm. Any bearing trouble or commutator flashing can be detected and remedied.

Rewinds Sent Out

No rewinding is done in the shop. Surface damage to windings are often repaired but in cases where coils require replacement or a complete rewind is necessary they are sent out to service shops.

Extensive records are kept to assure maintenance coverage according to schedule. These records also contribute to experience and cost data on which to base future maintenance policy as equipment grows older and needs more constant attention.

At present, the oldest equipment is only twelve years old. Engineer Cords keeps his equipment in the best of operating condition, yet avoids "polishing any brass"; that is, no motions are made that do not pay dividends "Traction equipment needs no babying. It's built rugged; we treat it rugged. It would be uneconomical to do otherwise."

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Lighting Techniques for DEPARTMENT STORES

Continuing previous discussion of lighting fundamentals, this article, fourth of a series, reviews practical methods of planning "light for selling" in store modernization or in new buildings.

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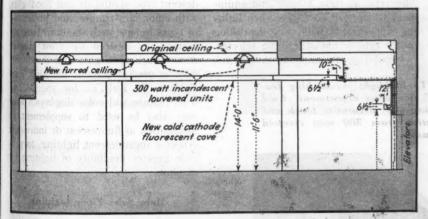
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By Berlon C. Cooper



DUE to building restrictions imposed by WPB Conservation Order L-41 during the war, and to the stopping of improvements to and remodelling of commercial and retail establishments at the beginning of the war, practically all department stores, both large and small, now have plans under way for extensive changes when WPB restrictions and availability of materials and labor will permit. Improvements in lighting constitutes one of the major programs.

The problems involved in lighting a department store are many and varied. They include exterior lighting for advertising value, show window lighting to attract and draw customers into the store, selection of light sources and lighting equipment to provide a satisfactory color quality of illumination for the various sales areas inside the store, show case and wall case lighting, the use of light as a part of the architectural and decorative treatment for different departments, and for highlighting displays. They also include the lighting of offices, restaurants, tea rooms, fountain shops, beauty salons, and many other areas which form a

TYPICAL SECTION through main floor of Hutzler Bros.' store shows location of incandescent lights and fluorescent coves. From one to three lines of 15 mm. cold cathode tubes operating at 30 or 60 ma. are used in various coves to meet varying lighting requirements.

DIFFUSED DIRECT LIGHT-ING from 300 watt semi-recessed silver mirrored glass reflector units combined with cold cathode cove lighting provides excellent color quality general illumination over entire sales area on main floor of Hutzler Brothers Department Store, Baltimore, Maryland.



Electrical Contracting, April 1945.

DRAMATIC ILLUMINATION of over 75 footcandles in Bond Clothing Company's Broadway store, New York City, is produced by 300 watt incandescent lamps in Holophane Controlens ceiling units combined with 40 watt white fluorescent lamps in three coves, one above the other.

part of the store, in addition to such service areas as stock rooms, sewing and alteration rooms, and mechanical equipment areas.

Lighting used skillfully, not only to serve the purpose of providing the best possible quality of illumination to enable customers to see undistorted the merchandise they buy, but also to enhance architectural effects and to blend with and become a part of the decorative treatment, will do much to create good will and satisfied customers for the store.

Building Exterior

Light can be used effectively as a means of advertising on the exterior of a department store building. Depending on the architecture of the building this use of light may be to accentuate architectural details, or to light the name of the store at night. It



must, however, be conservative and discriminatingly done to lend prestige to the establishment. Such lighting helps to establish the location of the store, and becomes the store's "face" or front, in effect, to the buying public. The type of light source and equipment which will best solve such lighting applications will vary depending on the type or use of lighting selected. Flexibility of equipment and switch

ager. Adequate equipment should be installed to provide a high level of uniform illumination over the entire display area of the windows. Incandescent type spotlights and floodlights, with color clip frames, and preferably of types for use with standard long life lamps, are desired by most display men. Such spotlights and floodlights may be used to provide the high level lighting, as well as for special low level feature and color displays. They may also be used to supplement an installation of fluorescent or individual reflector incandescent lighting, to provide greater flexibility of lighting for displays.

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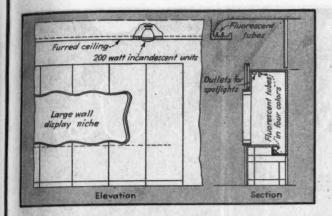
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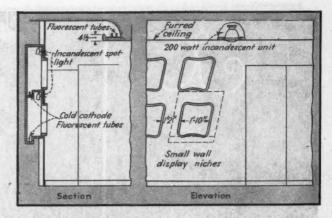
RECESSED LENS SPOTLIGHTS highlight eye-catching feature displays in Hutzler Bros.' fine dress department, Cold cathode fluorescent cove lighting adds decorative touch and supplements general illumination from 300 watt recessed incandescent louvered ceiling units.



Main Sales Floor Lighting

Here the store owner wants to achieve distinctiveness and individuality for the store. Lighting, skillfully used as a part of the interior design and decorative treatment, offers infinite possibilities for such individuality. In addition, an adequate intensity of illumination of the proper color quality will aid in selling the merchandise. The main sales floor usually accounts for a high percentage of the store's revenue. Many departments and counters for special feature sales are located here. These include such items as hosiery, handbags, cosmetics, scarfs, umbrellas. handkerchiefs, blouses, jewelry, candies, gifts, notions, stationery and greeting cards, and many others. Such variety in merchandise makes it important that a good quality of lighting be used throughout.





COLD CATHODE FLUORESCENT tubes, 15 mm. diameter, in white, red, blue and amber provide background lighting for large wall display in girdle department. Baby spotlights highlight the displays in white light. The fluorescent tubes have four-step control for varying intensity of the cold cathode sources. (Above)

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BABY SPOTLIGHTS accentuate displays in small wall niches while cold cathode tubes in color permit flexibility in background lighting.

COMBINATION LIGHTING from incandescent recessed ceiling units, cold cathode cove lighting and illuminated display niches in girdle department (illustrated in section above) provides light for selling and unusual artistic and decorative effect. (Right)

From twenty to fifty foot-candles of well diffused general illumination is desirable over the entire sales area. This general illumination should be supplemented with additional highlighting of the merchandise and feature displays, and by show case, wall case and display niche lighting.

The lighting result must be such that it creates a feeling of cheerfulness, and comfortable seeing. It must, however, be free from glare, harshness and exposed bright light sources. The color quality of the light must not distort the appearance of the merchandise, particularly clothing, cosmetics, and similar items where color is an important factor to be considered from the standpoint of the customer's satisfaction. It must be remembered that the color of daylight is not constant, that it varies over a fairly wide range between a cloudy overcast day and a bright sunny day. Also, the customer will look at the merchandise under various color qualities of artificial lighting. A color quality of illumination on the sales floor area that strikes



a happy medium to the varying lighting conditions under which the customer will subsequently see the merchandise should prove to be the most satisfactory one to use for lighting the merchandise when the sale is made.

A lighting technique which fulfills most of the requirements for general department store lighting is one which provides diffused general illumination from lighting units installed flush, semi-flush or surface exposed on the ceiling, supplemented with decorative and architectural lighting from coves, indirect wall or pedestal urns, or from the top of wall cases. Show cases and wall cases should be lighted separately to accentuate and highlight the merchandise in the cases. Feature displays on the sales floor should be highlighted from louvered or lens type spotlights and floodlights, preferably concealed from view by being installed flush in the ceiling, or behind columns or other structural details. Lighted display niches in walls at the end of aisles or in the center of long vistas are very effective in stimulating sales. Such

niches should be provided with spotlights to highlight the display, and with concealed lighting to provide white or colored background lighting. Examples are shown in the accompanying illustration.

Lighting equipment should be inconspicuous. Lines of light to influence traffic flow should be of low brightness, and appear to be part of the architectural or decorative detail rather than that of a lighting unit. This permits the undivided attention of the customer to be centered on the merchandise.

The selection of the light source for general illumination is most important. Incandescent light sources of 200 watts and larger have a color quality that has proved satisfactory for most sales areas. Fluorescent light sources are now being used to a considerable extent. With the lamps which are now available, the 3500° white and the 6500° daylight, the color quality is not always satisfactory where color discrimination is important. It is ex-

[Continued on page 199]

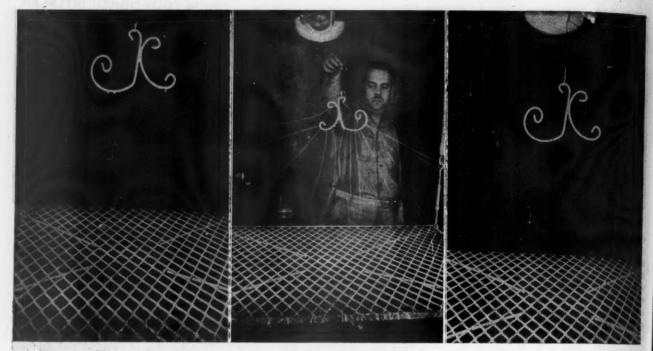


FIG. 1—ELECTROSTATIC DETEARING as demonstrated in a laboratory setup shows (a) paint "tears" forming as a dipped object is drying; (b) elimination of tears and excess paint when the electrostatic field is turned on; (c) the "deteared" object with a smooth uniform paint coat ready for the drying oven.

Painting Without

The application of electrostatic force to industrial painting eliminates "tears" from the dipping operation and conserves paint in the spraying process. Here's how it works.

NEW electrical process—electrostatic painting — has come to the fore industrially during this war period. Through its use considerable time, labor and paint have been saved in many war-jammed plants; better and more uniform protective paint coatings have been possible with an appreciable increase in production rate.

It had its inception back in the late 1930's when Harold Ransburg of the Harper J. Ransburg Company in Indianapolis, Ind., began toying with an idea. The company was manufacturing its normal peace-time line—ornamental metal stands, metal waste baskets and other domestic items. Because of the nature of the products, many of them had to be dip painted requiring a wasteful time interval—

from the production standpoint-during which the excess paint dripped from the object. What's more-during this process, unsightly "tears" of paint formed at the dripping points and had to be subsequently removed. It was a problem to secure a smooth, uniformly coated surface. During the spraying process, a quantity of paint was going out the exhaust vent as a fine spray and the time element inherent in securing a uniform coating over all parts of the object being painted was still present. In many cases sprays directed in different directions were necessary to accomplish the desired result and heavier sprays were sometimes re-

Mr. Ransburg's idea was to apply the well known Cottrell electrostatic principle (widely used in air cleaning processes) to painting—utilize electrostatic force to remove excess paint in the dip process, and conversely, in the spraying process, utilize this force to direct more of the paint spray to the object. The outcome was subsequent experimentation and development of the electrostatic "detearing" and spraying processes patented by the Ransburg Company for use with nonmetallic as well as metallic materials

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The Detearing Process

Neither of the processes is complicated. For "detearing" the dipped object is mounted on a thoroughly grounded conveyor. The object is then passed over a metal grid or plate that has an 85,000 volt negotive charge with respect to the

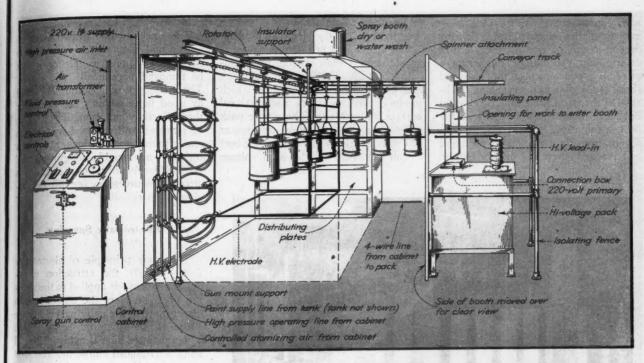


FIG. 2—TYPICAL ELECTROSTATIC SPRAY design showing arrangement of equipment and electrical components of electrostatic attachment. Control cabin et and voltage pack are mounted outside spray-booth.

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grounded item. The distance between the painted object and the metal grid is maintained at a minimum of seven inches (twice the normal spark-over distance) to prevent the possibility of a spark occurring between the object and the high voltage electrode.

Since opposite polarities attract each other, the excess paint is attracted to the negative grid—the paint spurting from the object in minute streams forming a pattern similar to that of the well known magnetic field (see Fig. 1-b). After leaving the electrostatic field, the object is covered with a smooth uniform finish without further danger of the formation of "tears" (see Fig. 1-c). In the straight-line dipping processes found in industry (see Fig. 3) the size and location of the grid is adjusted to the conveyor

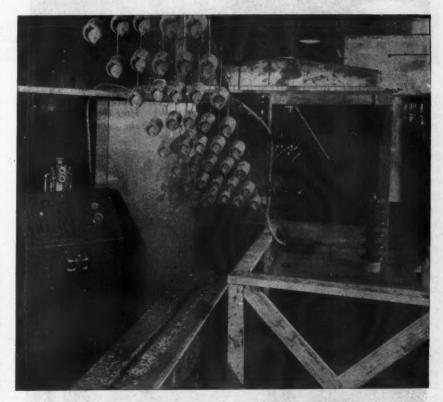


FIG. 3—WARPLANT APPLICATION of the "detearing" process. After being dipped, these fragmentation bomb parts on conveyor rack are passed over a high-voltage grid which removes excess paint. Control panel is at left; voltage pack at right.

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surfaces by point from a single cultomatic spray gun nords. Can is not rotated, if the field were of, out a smell band of the cautaines

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speed so that the painted object remains in the electrostatic field the proper length of time. Other factors determining the design and arrangement of equipment are the size and shape of the object, the type and thickness of the paint used, and the desired thickness of the finish. If left in the field indefinitely, paint would be removed from the object until the point was reached where the surface tension

of the paint would equal or be greater than the force of the electrostatic field.

The 85,000 volt negative potential is provided by a high voltage pack consisting of a 220/85,000-volt transformer and a half-wave rectifier tube which produces the necessary undirectional current and polarity. The power pack pulls a primary load of 1½-amperes at 220-volts, single-phase, 60 cycles. Short circuit amperage on the high voltage

grid is approximately 5 milliamperes.

The excess paint drawn from the object will naturally be deposited on the high voltage grid. Hence, it must be removed periodically and cleaned. The frequency of cleaning is dictated by good housekeeping practice rather than effective operation. The grid can be removed and replaced with a clean one without shutting down the process for any appreciable length of time. Aside from this occasional clean-up, no attention is necessary for this fully automatic operation.

Electrostatic Spraying

The same principle of electrostatic force—namely the attraction of op-posite charges—is applied to the spraying process. Here the objective is to direct more of the paint particles in the spray to the material being coate The unpainted part is again suspended from a grounded conveyor. The paint spray is given a negative electrical charge by directing it into an electrostatic field produced by a series of high voltage electrodes which are maintained at a negative potential with respect to the grounded article (see Figs 2 and 5). As the grounded, unpainted article enters this field, the negative charged paint particles are directed b the electrostatic force, to all surfaces of the article producing a smooth uniform coating. The net result is that considerably less of the paint goes out through the exhaust duct than during conventional spraying operations.

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One war plant utilizing this process reports a saving of approximately 40 percent in paint and 50 to 60 percent in labor. These savings will depend upon the specific setup in each plant. A soft spray with low atomizing and fluid pressures is used. The automatic spray guns are adjusted to conveyor speeds-the minimum being from three to four feet per minute. Spray guns are mounted outside the electrostatic field and are thoroughly grounded. This permits safe adjustment of the nozzles when necessary. Nozzles are directed at the work at an angle of approximately 10 degrees to the horizontal path of the work travel.

Electrode Shapes

The high voltage electrodes for the spraying process are either rods or wires suspended on each side and across the bottom of the conveyor path. The specific positions depend upon the shape of the parts being painted. They have a negative potential of 100,000 volts provided by a voltage pack similar to that used for the "detearing"

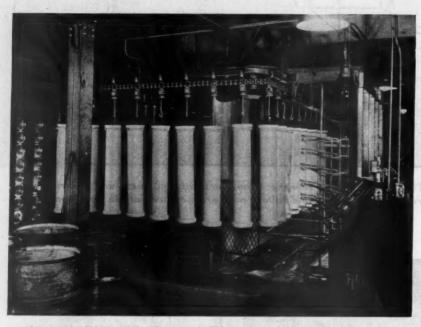


FIG. 4—ELECTROSTATIC SPRAYING installation in a warplant. Two identical units are installed for applying a zinc chromate primer and a grey synthetic enamel coat to Navy powder tanks. After leaving spray booth, conveyor carries the tank into an infra-red bake oven (at left).

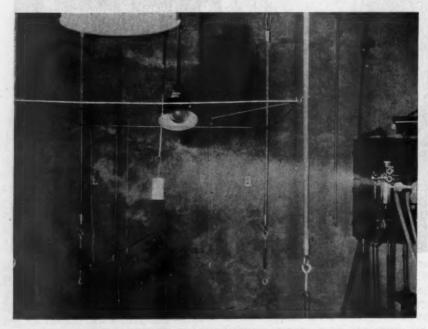


FIG. 5—LABORATORY DEMONSTRATION shows how a small container, suspended in an electrostatic field, is completely covered on all surfaces by paint from a single automatic spray gun nozzle. Can is not rotated. If the field were off, only a small band of the container would be covered.

PULES FOR INSTALLATION AND OPERATION OF RANSBURG ELECTROSTATIC PROCESSES

 Transformers, power packs, and all ejectrical controls are to be located outside the immediate painting area (not inside spray booths; well away from dip tanks, etc.).

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- The electrical installation is to be in accordance with the provisions of the National Electrical Code where such rules apply.
- Electrodes are to be rigidly supported in permanent locations and well insulated.
- Minimum spaces between electrodes and painted goods are to be at least twice the distance of the length of the possible sparkgap.
- All goods subject to the processes are to be handled on conveyors and be so fixed to the conveyors that the minimum spaces from goods to electrodes will be maintained under all circumstances.

Guards are to be provided where necessary to produce this result.

Installations at present are not permitted where goods being painted are handled manually. (Guards may be found practical which may modify this rule in the future).

 Automatic control should be provided to make the entire electrostatic equipment "dead" when vent fans and conveyors stop.

- Standard ventilation shall be maintained for the areas containing the electrostatic apparatus. The fan motors for the ventilating system are to be connected in series with the voltage pack primary.
- All painting process supplemented by electrostatic apparatus shall be protected by automatic sprinklers or other approved automatic extinguishing systems.
- Where necessary, adequate fencing, railings, or guards are to be provided to maintain safe isolation of the process from other work in the vicinity and to guard personnel.
- Signs designating the work zone as dangerous as regards fire and accident shall be posted at the process.
- Electrode insulators shall be kept clean and dry.
- Drip plates and screens, subject to deposits of flammables, shall be removable and taken to a safe place for cleaning.
- Cleanliness shall be maintained and stock or goods not stored within five feet of the process.

process. This pack pulls a primary load of 3½ amperes on the 220-volt, single-phase, 60-cycle circuit and has a high-voltage short circuit load of 10 milliamperes. To prevent the possibility of a short circuiting spark, the electrodes are placed at a minimum distance of 11 inches from the article, about twice the normal sparkover distance

Concerning Safety

Whenever high voltage is applied to electrical processes, the question of safety from electrical shock and—in the case of hazardous atmospheres—safety from electrical fire is introduced. Past experience with electrostatic coating—although somewhat limited—indicates that there is no undue hazard introduced when the process is correctly installed. That, of course, is contingent on installation and operation in accordance with the rules presented in an informative report to the National Fire Prevention Association in May 1944 (see table of Rules).

Electrostatic coating applications are limited to automatic processes—automatic spray guns playing on articles mounted to conveyor lines or automatic dipping—usually found in large mass production industries.

Proper arrangement of the equipment adds to the safety of the operation. The high-voltage pack is enclosed in a guard rail or fence (see Fig. 3). Where access gates are necessary, they are electrically interlocked with the primary of the power pack transformer thus disconnecting the transformer from the line when the gate is opened. Conveyor and exhaust fan motors are also electrically interlocked with the primary of the transformer so the voltage pack will be "dead" if either motor should stop.

Control Cabinet

The control cabinet, the only piece of equipment with which the operator comes in contact, incorporates the electrical controls for the electrostatic field (one switch for transformer primary; the other for the rectifying tube filament circuit) and the mixture and pressure controls for the automatic spray guns. Both the control cabinet and the voltage pack are located outside the spray booth.

Indications are that electrostatic coating tends to reduce the fire hazard

of flammable atmospheres, This, as outlined in a report to the N.F.P.A. at their Philadelphia meeting May 8-11, 1944 by Benjamin Richards, chairman, Committee on Finishing Processes, is due to the fact that more of the paint from the spray goes on the product instead of accumulating in the spray booth or exhaust duct. With "detearing", heavier paints having less than normal solvent content can be used and the removal of the excess before the material goes into the drying oven is apt to lower the concentration of flammable vapor in the oven, the report reveals.

Process Successful

Both electrostatic processes—"detearing" and spraying—have stood the test of numerous warplant applications; have saved time, labor, material: and increased production efficiency. Undoubtedly our electrical contractors, inspectors and plant electricians will encounter many more of these installations after the war is over when peacetime industry will be seeking the maintenance of production efficiency that our economy at that time will demand.

Intra-Plant MAINTENANCE

Training course in complicated controls and sequence operation provides Nordberg's electrical maintenance men with the "know how" to shoot trouble quickly and accurately.



ELECTRICAL MAINTENANCE CLASS studies the complicated wiring diagram of the boring bar control cabinet behind them, during one of their "field" trips in the plant. Instructor John Sheely (right) explains the operation of the unit.

NE of the most harrowing experiences an electrical maintenance man can encounter is to be stumped on a trouble shooting job where complicated interlocking controls and sequence operation are involved, particularly when he is aware of the vital need for getting the machine in operation as soon as possible. If he has had little previous experience with such controls, he is apt to throw up his hands in disgust and admit defeat. He just doesn't know where to start. Meanwhile an-

other will try his luck and may be able to locate the trouble. In the interim, the machine is down and some vital part of production is lagging—a condition management cannot tolerate if war production is to be maintained on schedule.

To avert such a condition, Nordberg Manufacturing Company, Milwaukee, producers of vital diesel engine equipment, organized an 8-week training course in its electrical maintenance department. They picked the best possible place to hold the classes—

right in the plant where the men could familiarize themselves with the complicated control equipment which they might be called on to service. Theres plenty of it too—both a-c and defor the machines required to produce the massive diesel engines dwarf the men who operate them. Some of the units have as many as 16 motors; many, such as large boring bars and milling machines, have huge contactor panels controlling the operation.

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Organizing the class schedule wasn't as simple as might appear on the surface. There were 50 men and six girls (who handled motor oiling, motor repair work and like chores) in the electrical maintenance department. To prevent undermining the effectiveness of the maintenance work, the men could be spared only a few hours a week for classwork and study. Having the crews working on three shifts per day complicated matters. The net result was a staggered schedule with the men going to class two hours per day on alternate days of the week. For example: Group 1 would attend class Monday, Wednesday and Friday of one week and Tuesday and Thursday of the next week. Group ? would fill in the other days. To permit more individual and personalized instruction, classes were limited to five or six men. To enable all men to receive instruction, three classes per day were held with the hours so arranged that all shifts were covered—the second shift from 4:00 p.m. to 6:00 p.m., the third shift from 6:00 a.m. to First shift crews were 8:00 a.m. handled during the day.

A full-time instructor, John Sheely, of the Milwaukee Vocational School staff took over the teaching assignment. Classroom work consisted of blackboard instruction, tracing of control circuits, following through sequence control operation and plenty of time for the men to pour over blueprint control circuits, take notes and ask questions. When a group had one control assignment mastered, Mr. Sheely took them out into the plant and let them follow through the operation of an actual control panel, study the contactors and back-of-panel wiring

Electrical Contracting, April 1945

TRAINING

By Carl Lau
Chief Electrician
Nordberg Manufacturing Co.
Milwaukee, Wis.

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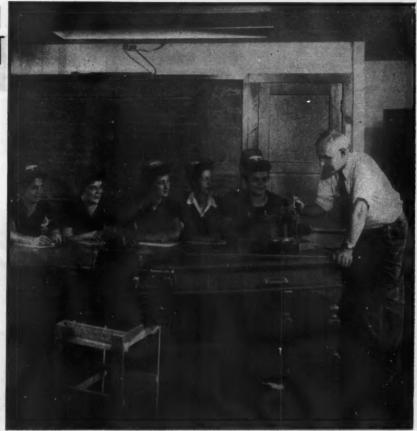
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while checking with the diagram they carried. Sometimes the men were "fortunate" enough to shoot trouble if a machine went down. This cycle was repeated until all men in the course had a good grasp of sequence operation and complicated control circuits; knew the step by step method of "shooting trouble" on such equipment; had satisfied themselves that they could handle this type of work.

Concurrently a separate course was given for the six girls in the electrical maintenance department. Here, instruction was confined to the fundamental theory of electricity, the operation of the motor, and motor repair work (three of them worked in the electric shop on motor repairs). Two of the girls are being trained to use electrical instruments—Meggers, industrial analyzers, ammeters, voltmeters, and others.

The training plans do not end here. A 10-week electronics course is now in operation. It combines fundamental theory with practical applicationsemphasis being placed on equipment now being used in the plant. Another Milwaukee Vocational School instructor, A. Braeking, is teaching the course—one 3½-hour session per week -correlating textbook material with the well known Westinghouse Training Course "Electronics At Work." Here, again, the men will have the opportunity of seeing the equipment they study in operation on production machines; of knowing what it will and can accomplish; of knowing they will be qualified to maintain it when the time comes.

And other courses will be instituted if the need arises. For education is, of necessity, a progressive art following technological developments. One of the best assurances of efficient plant operation is an electrical maintenance department that has the "know how" to prevent serious shutdowns and has the ability to act quickly and efficiently should an emergency arise. That is why Nordberg's progressive management has made these courses available to the electrical maintenance employees.



MAINTENANCE GIRLS of the electrical department get some pointers on motor windings from instructor John Sheely during one of their class-room sessions which include blackboard, paper work and actual winding.



THE SAME GROUP of electricians discusses the sequence operation of a large milling machine control cabinet. Sessions like this supplemented classroom work; gives trouble-shooter confidence in his ability.

INTERIOR OF TUNNEL showing parts on conveyor being quickly dried by the heat from 192 infra-red lamps. Tunnel is mounted on a mezzanine rack.

INFRA-RED Speeds



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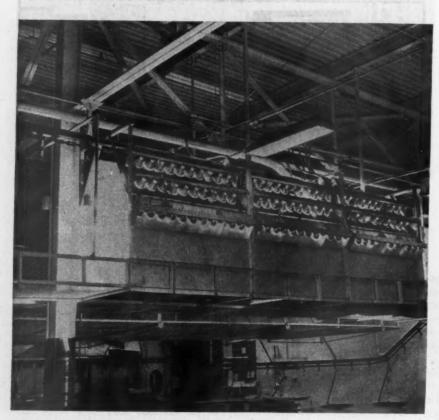
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PORTABLE BANKS of 17 infra-red lamps each cut drying time of Air Corps insignia stencilled on fuselages from six hours to 30 minutes.



INFRA-RED TUNNEL permits 50 percent more parts to be handled daily by reducing drying time for prime paint cont. Conveyor carries parts slowly through the tunnel.

HEN . the Air Corps planes, it wants them in a hurry and in quantities never before dreamed possible. What's more they got-and are getting-them, thanks to the ingenuity and "know how" of American industry. The major portion of this production miracle can be attributed to techniques evolved to save time-one of the most important strategical weapons of war. Infra-red drying has played a vital role in this fight against time, removing entirely an initial bottleneck to speedy production.

In the paint shops of the Texas Division of North American Aviation, Inc., Dallas, infra-red drying has speeded up one vital operation in the production of P-51 Mustang fighters approximately 2,300 percent. Powerful batteries of infra-red lamps are used to dry the paint on everything from thousands of small parts and assemblies to the Air Corps insignia on the completed ship. In addition, they are getting a much better paint job and retouching and reworking has been virtually eliminated—a condition that was prevalent when air drying was utilized. Rainy, damp and cold weather are no longer problems.

Electrical Contracting, April 1945

Painting time for P-51 Mustang fighter sections reduced by infra-red drying.

Mustang Production

Concentrations of lamps ranging from small portable banks to long tunnels using up to 200 lamps are used in this plant. In one paint shop, in excess of 50 percent more small parts and assemblies are handled each day since the construction of a tunnel utilizing 192, 250-watt lamps (three tiers per side, 32 lamps per tier). Here a conveyor carries the small parts with their prime coat of paint through the tunnel. After leaving the tunnel, they are given their second coat which dries as the conveyor moves through the circulating room air.

Painted Mustang wing sections, formerly requiring 24 hours for air drying, now emerge from a double stationary bank of infra-red lamps within 45 to 60 minutes. Each parallel bank contains three rows of 250-watt lamps.

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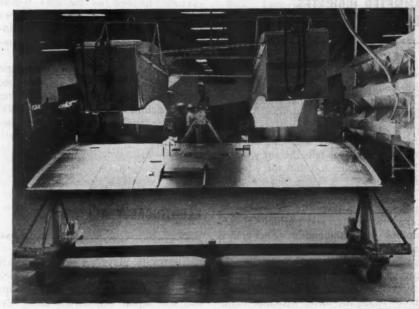
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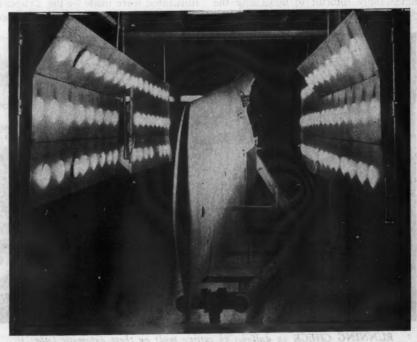
The drying of non-skid, carborundum grip, catwalks on the center section of the AT-6 Texan trainer presented a problem until hooded banks of infra-red lamps were designed to do the job. The metal hoods, each containing 50 lamps, are the precise shape of the center section on which the catwalks are cemented and are raised and lowered by means of "yoyo" hoists (a counter-balanced arrangement). Each hood, providing a highly concentrated heat source from its three rows of lamps, is placed over the catwalk and clamped to the center section dolly. A protective coat of paint on the center section is dried at the same time (hood is perfectly balanced so it will remain stationary in any raised or lowered position). The former drying time of two to four hours (natural air at room temperature) has now been cut to 30 minutes.

One of the last drying jobs done on the planes is the stencilled air corps insignia. Portable banks of 17 infra-red lamps each (three rows controlled by two switches) cut this drying time from the former 6 to 10 hours (air dry) to the present 30 minute schedule.

Typical circuiting for the infra-red applications in this plant consist of eight lamps per circuit, each controlled by an individual switch.



INFRA-RED HOODS throw a high concentration of heat on the catwalks of AT-6 (Texan trainer) center sections. Each hood contains 50 lamps in three rows. Former drying time of 2 to 4 hours is cut to 30 minutes.



MUSTANG WINGS emerge from this stationary bank of 96 lamps within 45 to 60 minutes. Air drying time formerly was 24 hours. Note adjustable, hinged upper and lower sections of each side of bank.

BRIEF ARTICLES about practical methods of installation and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

PRACTICAL METHODS

AMMETER INDICATES DULL CUTTING TOOLS

-INDUSTRIAL

Operators of automatic lathes on rough turning of cylinder barrels at the Dodge-Chicago plant, Division of Chrysler Corporation manufacturers of B-29 super-bomber engines, have a quick visual means of knowing when the cutting tools are becoming dull. An ordinary ammeter tells the story before the tools become too dull for effective use.

A 0-100 ampere range meter is mounted on a box directly above the magnetic starter and pushbutton controlling the lathe motor. The dial is turned toward the operator so he can easily glance at it as he watches the cutting operation on the lathe bed.

Connected between the starter and motor leads, the meter indicator maintains a fairly stable position when the three to six cutting tools on each machine are in good condition. As the tools become dull, the cut becomes much more difficult to make and the power requirements increase. If the

operator notices the ammeter needle swing upward on the scale, he knows there is trouble in the making and investigates before the casting he is machining is ruined.

Approximately 30 to 40 automatic lathes in this department are equipped with these ammeters. Motors operating these machines are of the 60 hp., 1800 rpm. size and operate on a 3-phase, 440-volt power system.

CREW QUARTERS ELECTRICALLY HEATED

WIRING

Electricity plays an important part in the operation of landing craft which bridge the gap between cargo ships and the actual beachheads along the fighting fronts. One of its many uses is to increase the living comfort of the crew quarters aboard the craft.

Heater installations like the one illustrated were made by the Tri-State Armature and Electrical Works,



ELECTRIC HEAT in crew quarters of LCT craft is provided by grille-enclosed space beaters equipped with an "on" and "off" toggle switch. Circuit connection is of a portable type through a weatherproof receptacle and plug. Units are 1 and 2 kw. in size.

Of

Electri

Memphis, Tenn., in hundreds of landing craft wired for a Memphis ship-builder. In these LCT craft six electric space heaters are standard equipment. The units range in size from 1 to 2 kw.—depending upon the size of the area to be heated.

The heater illustrated is typical of those installed throughout the craft Installation methods are the same, embodying a plug connection to facilitate quick replacement in the event of failure. Marine type cable, emanating from a fuse panel inside the crew quarters, runs down the deckhouse bulkhead into a watertight receptacle which is screw-mounted to welded pads. If there is more than one heater in the deckhouse, the cable leaves the bottom of the receptacle and continues on to the next outlet. Wherever the cable enters or leaves the receptacle it goes through a packing gland to form a water tight seal.

The heater unit is mounted to brack-



RUNNING CHECK on dullness of cutting tools on these automatic lathes is provided by ammeters (circled in photo) between the starter and motor leads. As tools become dull, more power is required. Operator notes upward swing of ammeter needle and investigates,

SYLVANIA NEWS

CONTRACTOR EDITION

APRIL

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Published in the Interests of Better Sight and Sound

1945

Survey Reveals Strong Trend to Fluorescent Lighting in the Home

Keen Public Interest Points to Big Postwar Market in Residential Field

Popular interest in fluorescent lighting in the home—as revealed by an impartial survey conducted by a leading market research organization, at the request of Sylvania Electric's Sales Research Department—indicates considerably expanded use of this type of illumination in the residential field after the war.

Of the more than 3,000 persons interved in the survey, only about 10% have fluorescent lighting. Almost half of these, however, expect to install more fluorescent after the war.

Of those now without fluorescent lighting, 16% plan to install it in one or more

rooms. Among this group, the kitchen is by far the most popular choice. (See percentages shown in the chart below.) The living room was the second choice, followed by bathroom, bedroom, dining room and basement. With those now having some fluorescent lighting, the bathroom outranked the living room.

From this evidence of growing interest in fluorescent lighting in the home, it appears that electrical contractors, in formulating their postwar business-building plans, would do well to give careful study to the residential field, still a relatively untapped market.

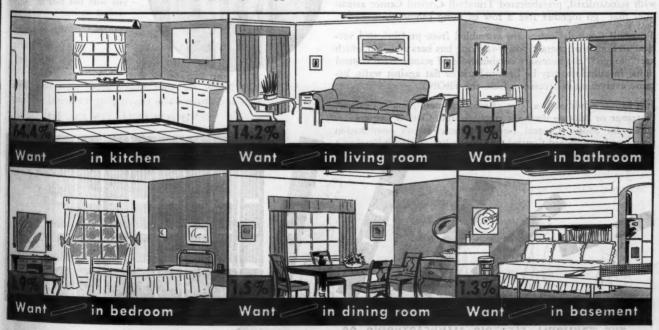
SYLVESTER SURVEY



"You plan to have fluorescent lighting in both the kitchen and bathroom. Now, how about the basement?"

DID YOU KNOW...

That 79% of the people having fluorescent lighting in their homes expressed themselves as entirely satisfied with it?



SYLVANIA FELECTRIC

SYLVANIA ELECTRIC PRODUCTS INC., Salem, Massachusetts

MAKERS OF FLUORESCENT LAMPS, FIXTURES, ACCESSORIES; INCANDESCENT LAMPS; RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES

TRUMBULL (S) CONTROL CENTERS

This will give you some idea

how quickly you can

set them up

Below: Plugging Control Center unit into 131/2" standardized section. Note "stabs" which make contact with bus bars.

Installation of electric control or distribution centers used to be a costly, time-consuming job . . . often involving "special engineering".

But no more! Now you can figure the number of power control "packages" you need . . . and set them up in a matter of hours with standardized, prefabricated Trumbull Control Center assemblies that "go together like a row of filing cabinets".

Trumbull Control Centers are assembled from prefabricated vertical sections that contain power-carrying bus bars and into which are "plugged" the necessary combinations of standardized control units. Installations may be back-to-back or flat against walls, because everything is accessible from the FRONT.

Just as you would shift a "row of filing cabinets", you can extend, rearrange or relocate these extremely flexible Control Centers . . . either for Motor Control (with magnetic starter combination units) or Switchboard Control (with switches or circuit breakers) for control of power or lighting feeder circuits

Left: Showing "stabs" on control unit in contact with bus bars in vertical section.

Plan NOW for your future needs . . . save Time, Cost and Space while you step up electrical efficiency. SEND FOR BULLETIN NO. 411



THE TRUMBULL ELECTRIC MANUFACTURING CO.

A WENERAL BLEETING

ORSANIZATION

OTHER FACTORIES AT NORWOOD (CINN.) O. SEATTLE — SAN FRANCISCO — LOS ANGELES



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Electrical Contracting, April 1945

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ets welded to the bulkhead. A heavyduty flexible rubber cord connects the unit to the receptacle through a waterproof plug equipped with a threaded collar which screws on to the receptacle plate keeping the plug intact and making the connection watertight. A single clamp fastens the cord to the bulkhead to keep it out of the way. A toggle switch, mounted to the metal grille of the heater unit, provides a means of turning the unit on and off.

OUTDOOR SPOTWELDING BY PORTABLE UNIT

INDUSTRIAL

Already extensively used in inside manufacturing operations, spotwelding has now moved out of doors at The Glenn L. Martin Company, Baltimore, Maryland, where special portable equipment was recently used on the flight line to attach an added .030 stainless steel part to the baffle of the PBM Mariner exhaust system.

A special portable spotwelder, consisting of a control and transformer unit and a hydraulically operated welding gun was assembled by Martin welding engineers for this job. The control and transformer unit was then positioned over the airplane in which the welds were to be performed by a traveler crane, with the gun in turn suspended from the transformer and control unit. Power was supplied by a special 500-foot cable feed, with an additional 8-foot line running from the transformer and control to the welding gun. Water cooling was not necessary



SPOTWELDING done outdoors to attach additional parts to the PBM Mariner exhaust system baffle on the flight line. A special portable spotwelder has been assembled by Martin welding engineers from standard equipment.

since welds per minute were reasonably low, vastly simplifying the operation.

Although this is the first reported instance of the outdoor use of spotwelding equipment, welds produced were of production quality.

BEADED TUBING MAKES BETTER JOINTS

-WIRING

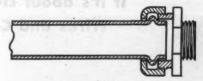
Bill Templeman, Premier Electric Construction Co., Chicago electrical contracting firm, is a stickler for A-1 workmanship—doing a job that will

stand up. That's the best reputation that a contractor can have. And it does reduce call-backs to a minimum.

Premier has done a lot of work with thin-wall tubing (E.M.T.) both on construction work and production wiring (wiring motors on machines, etc., for the manufacturer). Gland ring type couplings are all right for straight tubing work, but when it comes to connections to outlets, motor terminal boxes, etc., Bill wants something that will be more apt to stand excessive stress and strain. Also, he has experienced some difficulties with the rings not fitting properly; and the resultant lost time, trying to make a good connection, bores into labor estimates.

His solution is to use a beaded joint—run a bead on the tubing and have the collar of the connector press against this when the coupling is tightened. The gland ring, of course, is discarded. Here's how it is done.

The collar of the connector is unscrewed and slid over the tubing to be used. A bead is then run on the end of



Bead on E.M.T.

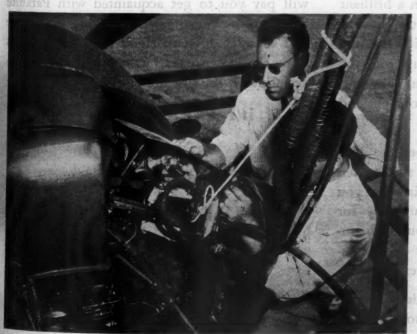
STANDS THE GAFF—a beaded joint on thin-wall tubing will take more punishment than the gland-ring type on connections subject to vibration or undue stresses, according to the observations of one contractor.

the tubing with a beading tool. The gland ring is removed from the body of the connector and the connector then screwed into the female collar which is brought up to the newly formed bead. By tightening the connector, this collar is pressed firmly against the bead forming a connection that is difficult to loosen by vibration or undue stresses. Net result—a better connection that will stand more abuse and frequently a reduction in non-productive labor on the job.

LIGHT TO SEE PANEL CONNECTIONS

INBUSTRIAL

Control panel for the operation of hot mills in steel plants and kindred industries are always impressive looking pieces of equipment with hundreds of contacts operating to reverse the main drive motor, operate the rolls, and the numerous other stages of hot mill operation. This means hundreds of connections behind such control panels—connections that may be jar-



CLOSEUP of the bydraulically-operated welding gun. Note the power cables, control cables and the flexible bydraulic line.

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Wires and Cables



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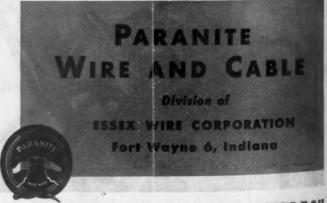
AC, a modest fellow with a brilliant twinkle in his eye, has become a tradition to everyone connected in any way with Paranite Wire and Cable. He has grown up with the organization, and can look back on many outstanding achievements in the development and improvement of insulated wires.

You'd never know it, though, because Mac doesn't talk much. But his slow, soft-spoken reply to any question will either impress you deeply or make you howl with laughter—for there is a rare combination of sound, down-to-earth logic and keen, dry wit deeply entrenched above those twinkling eyes.

Whether you're an architect, builder, contractor, engineer, manufacturer, or wholesaler — it

will pay you to get acquainted with Paranite and reap the benefits of Mac's long experience and sound judgment. He is the man who has done the most to help us continue using, conscientiously, the slogan...

If it's PARANITE it's right!



ELECTRICAL WIRES AND CABLES

"BETTER THAN CODE REQUIRES"

Electrical Contracting, April 1945



GOOD LIGHTING FACILITATES maintenance of control wiring on this bot mill panel. All circuit identification and contacts are clearly discernible under an average of 25 footcandles of fluorescent illumination.

red loose through vibration; that should have periodic inspection and maintenance.

Such a control panel operating a hot mill at the Bridgeport Brass Ordnance Plant in Indianapolis is located in the generator room adjacent to the mill. The complete panel is divided into two sections—each 26 feet long and mounted back-to-back, six feet apart. Joining these two panels is a steel roof forming a tunnel-like enclosure.

Because of this construction feature very little of the generator room light gets behind the control panel. The electric shop foreman at the Bridgeport Brass Plant, wants to be able to maintain equipment according to a definite plan. And he wants his men to have good lighting when they are working on such equipment—particularly when it means tightening up connections of control circuits, electrical contactors, solderless connectors, replacement of resistors and other auxiliary equipment, or making meter check-ups.

The net result is that the control panel enclosure has been flooded with an illumination intensity, on the vertical plane, ranging from 12 footcandles at three feet above the floor to 38 footcandles at a height of six feet from the floor. Providing this illumination is a single row of six, 40-watt 48-inch, 3500 deg. white fluorescent lamps mounted, seven feet above the floor, direct to the steel roof of the enclosure.

The men have no difficulty, now, when working on this complicated con-

trol panel. Coded tags identifying control circuit conductors and connections are easily read. There is no difficulty in reading instruments used to make various tests. There is little danger of causing short circuits by having tools inadvertently bridge terminals. It all adds up to a better maintenance job in a shorter period of time—an important consideration, today, when an unexpected shutdown of the mill might cause a drop in production of the vital war materiel on which the plant is working.

OPTICAL GLASS CLEANING FLUID IS ELECTRICALLY HEATED

INDUSTRIAL

When optical glass is cleaned in a northern Indiana plant, it is swished back and forth through a tank of heated cleaning fluid by an operator who holds the piece of glass with a pair of tongs. When the glass is removed from the fluid most of the excess is shaken off and the balance, due to the high temperature of the fluid, evaporates quickly. A special type of cloth is then used to polish the glass.

Electric heaters are used to bring the cleaning fluid in the tank up to the required 180 degree F. level. The copper fluid tanks are approximately 24-in. long, 12-in. wide, and 8-in. deep. As reported by the General Electric Company, each tank is equipped with two, 500-watt strip heaters which are mounted to the bottom of the tank. Each tank is kept half full of the clean-

ing fluid and temperature is thermostatically controlled at the individual tanks.

These electrically heated tanks are used in connection with the manufacture of war materials incorporating optical system.

OBSTRUCTION LIGHTS ON EXISTING POLES

WIRING

Although it is the policy of the Civil Aeronautics Administration to recommend removal of all obstructions from airports whenever possible and to have future fields built free from such hazards, it frequently occurs that existing obstructions cannot be removed. In such cases the obstructions must be clearly marked with red lights consisting of weather proof fixtures and prismatic glass globes which give an aviation red light from all angles above 15



KICK PIPE PROTECTION for feeder cables emanating from engine room switchboard is provided on this landing craft installation made by the Tristate Armature and Electrical Works of Memphis, Tenn. Rigid Navy specifications require such protection—a feature of all marine wiring—where cables pass through decks and are subject to mechanical injury from equipment, cargo and other causes. Kick pipes are welded to the deck structure and equipped with packing glands at the top to provide a waterproof seal around the cables.

7/conversion ans DOWET conversion



Rearrangement and replacement of plant machinery generally offers many opportunities to effect economies through revamped electrical arrangements. In many cases, transformers can be employed to reduce costs or to improve operations. One example is where long runs of expensive low-voltage wiring can be replaced by high-voltage circuits with individual transformers at the driven machines. In other cases, distribution transformers can be advantageously placed at the load center, with

resulting increased efficiency and lower operating cost on machines.

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degrees below the horizontal to the zenith. Such lamps are either 60 or 100 watts for multiple circuits or special traffic-signal lamps rated 67 and 111 watts with three times normal life.

All obstructions projecting above a glide angle of 30 to 1 from the end of the runway or landing strip and those which are outstanding above adjacent objects within one half mile of the airport should be marked by means of such lights. This frequently includes utility (telephone, or power) pole lines which cannot be removed.

Recommendations for marking pole lines call for a red obstruction light on each pole along the airport and on at least three poles beyond the airport in each direction. It is frequently necessary to mount obstruction lights on existing poles containing power lines. When this occurs, attention must be given to the installation of the feed wires. There are three suggested methods:

1. Running the wires under the ground with a tap at each pole.

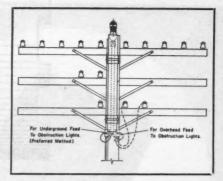
2. Running the wires on a crossarm located below the existing wires.

3. Running the wires above the existing circuits making use of the top crossarm or by mounting an extension upon the pole.

Regardless of the method of feeding the obstruction lights, the units must be fairly accessible for maintenance and lamp replacement purposes. This means that a person should not have to crawl through existing power wires to reach the fixtures. One method suggested by the Civil Aeronautics Administration and approved by the Army and Navy overcomes this hazard with apparent ease. It is outlined in the C.A.A. drawing ANC-1030.

The scheme involves the use of a 5-inch fibre conduit sleeve long enough to reach from the top of the existing pole to a point below the lowest crossarm. This sleeve is mounted to the pole by two, 2-inch by 3-foot bands of No. 16 gage metal.

The obstruction light fixture is mounted to a length of $1\frac{1}{2}$ -inch fibre conduit through a 1-inch by $1\frac{1}{2}$ -inch close nipple and a reducing adapter. A $\frac{3}{4}$ -inch hard wood dowel near the bottom of the 5-inch fibre conduit sleeve

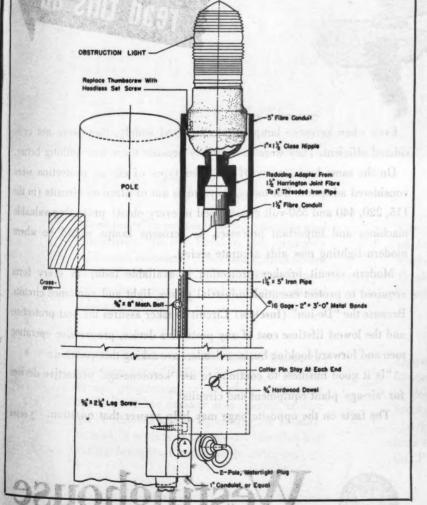


ELEVATION showing position of sleeve with respect to pole crossarms; also underground and overhead feed to obstruction light. Maintenance man need not hazard crawling through wires on crossarms to service fixture.

passes through both the sleeve and the 1½-inch fibre conduit pedestal on which the fixture rests. When this is in place—held by a cotter pin stay at each end—the obstruction light is held at the proper position at the top of the pole. A two conductor rubber covered cord connects the obstruction light to a receptacle outlet on the pole through a two-prong water tight plug. This plug may be fed either by an underground service or an overhead drop from conductors on a crossarm above.

Servicing procedure for this type of installation is as follows: Make sure the obstruction light circuit is de-energized; remove watertight plug; remove cotter pin and hard wood dowel; lower fixture for maintenance. After the fixture has been repaired or relamped, it is raised in the insulating sleeve, the dowel replaced and the plug connected.

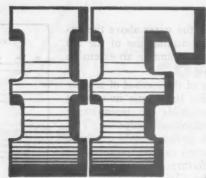
This scheme is satisfactory for both series and multiple circuits as long as the plug is not removed under load. The method oultined has been approved during the war emergency as a substitute for mounting the obstruction lights on separate poles.



SLEEVE TYPE METHOD of mounting obstruction lights to existing utility poles. Scheme permits easy and safe maintenance of units.



STANDING is J. D. O'Connor, now president of the Northern California Chapter, National Electrical Contractors Assn. The picture was taken during a visit of Paul Geary, assistant general manager, NECA. At the head table with O'Connor are William J. Varley, field representative for NECA; Paul Geary.



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Even when kerosene lamps were employed widely, they were not considered efficient. They were used simply because there was nothing better.

On the same basis, many of the older types of circuit protection were considered adequate. But today, they are as out of place on circuits (in the 115, 220, 440 and 550-volt classes used in every plant) protecting valuable machines and important processes, as kerosene lamps would be where modern lighting now aids accurate seeing.

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The facts on the opposite page may help answer that question. J.405H



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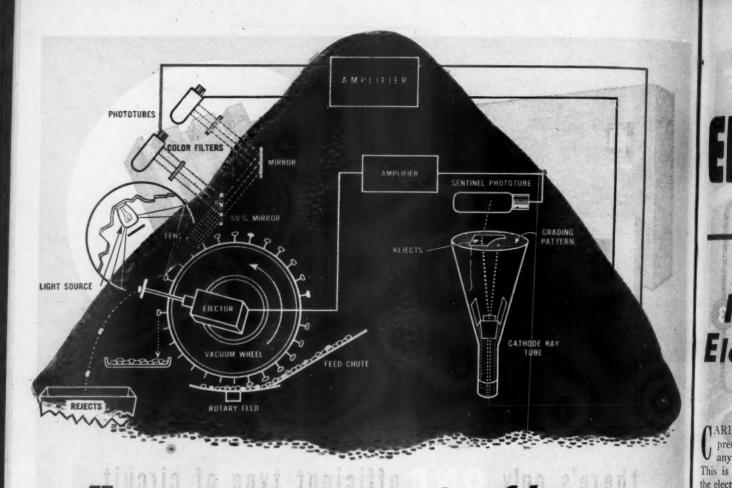
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The output of each phototube is fed into dual-channel amplifiers and from there to opposite deflection electrodes of an RCA cathode-ray tube. The cathode-ray beam is deflected vertically and horizontally in proportion to percentage of red and green light picked up by phototubes.

A mask covers one area of the cathode-ray tube screen. The beam falls in this area when the percentage of red and green is acceptable. When the beam falls on the unmasked area of the screen, it means that the color is not acceptable. A "sentinel" phototube picks up the "off-color" signal and actuates a relay which rejects the faulty bean.

Turn to Electronics for Solution of Your Own Problems: For information on this equipment, write to Electric Sorting-Machine Company, Grand Rapids, Michigan.

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Electron tubes are providing a practical solution to hundreds of diversified manufacturing problems—process-control, machine-control, heat-treating, plant-protection, and a host of others Consult with RCA tube-application engineers for information or advice on use of electron tubes in the design of your own equipment. For examples of electronics at work in our own factories, send for the free booklet "Electrons in Action at RCA." Write to RCA, Commercial Engineering Section, Dept. 62-54S, Harrison, New Jersey.

> THE FOUNTAIN-HEAD OF MODERN TUBE DEVELOPMENT IS RCA



Electrical Contracting, April 1945

ELECTRONICS

Installing, Maintaining and Servicing Electronic Resistance Welding Control—I

MAREFUL planning should always precede the actual installation of any type of electrical equipment. This is especially true in the case of the electronic controls of the resistance welder. Extraordinary consideration should be given the power supply, and the wiring to the control. . Prolonged shutdowns can be largely eliminated with adequate protection for the power system, proper cooling water for the ignitron power tubes, and accurate checking and recording of the operation of the electronic tubes. If, in addition, the proper auxiliaries, spare parts, tubes, and adequate instruments are readily available, repairs can be made promptly and even brief shutdowns materially reduced.

Location

The physical size of the control is usually determined by the size of the welding machine which it operates. Most small welding machines up to 3 kva. are bench mounted, and in the majority of cases the controls are small enough to mount on the bench along-side them as in Fig. 1.

If necessary, the control can be mounted under the bench, but this is not recommended and should be done only as a last resort. For one thing, such a location is generally subject to greater dust accumulation. For another, the control is exposed to a number of dangers from mechanical abuse to the possibility of metallic objects falling into the ventilating lowers and causing shorts. Servicing of the control is invariably compli-

W. J. Gorman, Jr.
Industrial Control Engineering Div.
General Electric Company
Schenectady, N. Y.

cated by the presence of material trays and tote boxes, which in addition, tend to reduce the ventilation required by the controls thus shortening the life of the tubes and parts. Furthermore, it is difficult for service men to work efficiently in a cramped position beneath the bench with the generally inadequate light.

In applications where several welding machines operate from a single control, the panel should be situated at one end of the bench supporting the welders. However, the practice of operating more than one welder from a single control is not recommended since it is generally uneconomical. In the first place, a complicated interlocking system is required; and secondly, production speed is materially reduced, resulting in a lower overall production efficiency.

Controls designed for welding machines larger than 3 kva. are floor mounted and can be located remotely or close at hand, depending on the space allowed for the welding setup. A larger welding machine will sometimes have the control panel mounted within the machine frame, as shown in Fig. 2. This eliminates the problem of locating and installing the control. In such cases, it is highly desirable to mount the welding machine so that the port holes and doors of the machine frame are accessible.

In the majority of installations, con-

trol panels are located adjacent to the welding machines, as shown in Fig. 3. This is particularly desirable where a variety of work is to be done on a single machine. Placing the control within convenient reach of the operator enables him to quickly change the time and heat settings, as necessary. Again, provision should be made to permit servicemen ample room to completely open control-panel doors. The practice of piling stock close to the control should be avoided, and operators given instructions to that effect.

Circuit breakers, fuse boxes, meters, and other controls associated with the welding machine should be mounted near the main control panel. A neat appearance is accomplished by mounting these parts on angle-iron frames set on the floor, or running from floor to ceiling.

To facilitate the keeping of records,



FIG. 1—Control panels of small units should always be mounted atop the bench, never beneath.

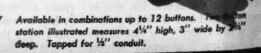
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Electrical Electrical Contracting, April 1945

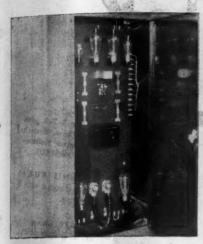


FIG. 2—The control panel for a large resistance welder is sometimes mounted within the machine frame.

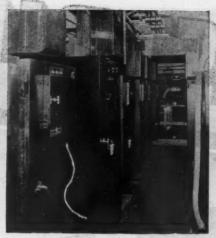


FIG. 4—Balcony-mounted control saves floor space in addition to other advantages when settings remain unchanged.



FIG. 5—Remote heat and timing dials are shown mounted within the machine frame of this seam welder.

each of the welding machines should be given a number and each electrical device associated with it, the same number followed by an alphabetical letter. Identifying numbers and letters should be plainly printed or painted on each piece of equipment.

For large production installations where a number of welding machines are in the same area, and where control settings are seldom changed, it is very often advantageous to mount all of the controls on a balcony above or nearby the welding area (Fig. 4). The centralization of all welding controls assures accessibility at all times, resulting in efficient servicing. Also, mounting the controls above the floor makes it possible to place the welding machines closer together, thus conserving valuable floor space and eliminating the possibility of damage to the controls by floor trucks and careless personnel. In addition, floor installations require each individual panel to be locked to prevent unauthorized persons from tampering with the control; while with balcony installations, only the door of the stairway leading to the balcony needs be locked.

The above recommendations also apply to gun welders and other forms of portable welding equipment. Where space is limited, or when the control panel might be subjected to mechanical shocks, it is generally advisable to mount the control at some distance from the welding machine and to install the control dial plate on (or in) the welding machine frame, as shown in Fig. 5.

Power Supply

Resistance welding machines generally impose a large intermittent single-phase load at low power factor on the distribution system. The power factor is usually between 25 and 50 percent, which is low compared with that of other electrical apparatus. The reason for this unusually low power factor lies primarily in the physical configuration necessary in the machine parts carrying the welding current from the welding transformer to the electrodes.

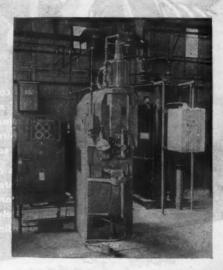


FIG. 6—Individual power transformer (2300/460V) supplies welder. Note high-voltage cutouts, low-voltage air circuit breaker, and control panel.

That is, it is necessary to separate the two arms in order to insert work between the electrodes. The greater the separation and the longer the arms, the lower will be the power factor.

Because of the nature of resistance welder loads, it is advisable to have a separate low-voltage feeder throughout the welding area. The step-down power transformer supplying this feeder should be located as near as possible to the welding controls. Long feeder lines should be avoided since, the longer the line, the greater the voltage regulation at the welding machine. Most electronic welding controls will tolerate up to 10 percent voltage variation without changing timing.

A better welding installation may be obtained by using a separate power transformer for each welding machine, located as near as possible to the control and the machine (Fig. 6). With such installations, it is not necessary to consider possible electrical interference to other welding machines

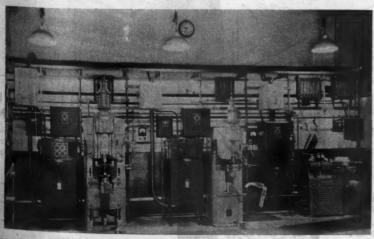


FIG. 3—Electronic controls, in the majority of installations, are located adjacent to the welding machines.



UNISTRUT consists of (A) a slotted hollow

Build 'em 1-2-3, with a Hack Saw, Wrench and Slotted Hollow-Square UNISTRUT.

O CUT UNISTRUT to length desired with a hack saw.

2 LOCATE fitting and nut at proper poi

3 BOLT securely with a turn of the wrench.

square 1% x 1%; (B) a standard springheld nut attachment which can be located in any desired position longitudinally in the hollow square section.

The nut has corrugated slots which fit over and bite into the in-turned edges of the hollow square section and hold the attachment securely in position, when tightened with an ordinary wrench.

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since very little will be transformed back to the high-voltage feeder. Separate transformers for each welder may not he economical in large production factories, but a compromise should be arrived at whereby not more than two or machines three operate from a single power transformer. Interference or regulation problems are almost always the result of attempting number of welders to operate a large from a low-voltage feeder of insufficient

ient capacity.

In factories where voltage variation and regulation exceeds 10 percent, accurate timing and control may be assured if a separate source of power is used for the control panel. However, the same electrical phase relation should exist between main welder power and control power. Most welding control panels have provisions in the wiring for easily isolating the control circuit. The wiring diagram of the welding control panel will describe the wiring changes necessary to isolate this circuit.

Regardless of whether the same or a separate supply is used for the control and the welder, it is advisable to install a control power switch which will enable the control circuit to be energized when the main power switch or circuit breaker is open. Thus, in case of trouble, measurements may be made in the control circuit without applying power to the welding machine.

Lack of Service Capacity

In some cases, a large resistance welding load presents such difficulties to the utility supplying the power that it is frand necessary to apply restrictions to the use of such equipment. Some of the reasons for these restrictions are:

1. Flickering of lights each time a weld is made.

2. Interference with other electrical apparatus on the same line.

3. Tripping of circuit breakers as caused by the high current surges.

In such instances, the supply problem may be simplified with the use of capacitors placed in series with the primary of the welding transformer to improve the power factor of the



FIG. 7—Two floor-mounted cabinets on extreme right house series capacitors for this spot welder.

welder to unity. The consequent reduction in kva. demand will bring about the following beneficial results:

1. Welding machines may be installed on existing feeders too small to supply the usual low power factor machines.

2. Heavier welds are possible from a given feeder.

3. Interference with other welders and apparatus on the same feeder is minimized.

4. Light flicker is reduced or completely eliminated.

5. Special low impedance powersupply transformers are not needed.

6. Additional machines can be used on the same feeder, providing all are equipped with series capacitors.

Series capacitors can be applied to spot, projection, seam and butt resistance-welding machines. They can also be applied to existing welding machine installations, but because of the nature of the electrical circuit, welder transformer and capacitor voltages are increased above the line voltage. For this reason, it is necessary to use control equipment and welding transformers suitable for these higher voltages.

Because of their size, capacitor banks for large machines are usually mounted at some remote point, such as on a balcony. On smaller installations the capacitor racks are mounted near the welding control, as shown in Fig. 7. Being static devices, capacitors present practically no maintenance problem. For this reason, they are often suspended from the ceiling or mounted at some remote point to conserve valuable floor space.

Wiring

Of the two classes of wiring, open and conduit, the latter is preferred for welding installations. Although open wiring is altogether cheaper and easier to install, the inherent advantages of conduit wiring will justify the additional time and expense involved.

As in the case of the electrode arms of the welding machine, the farther apart the feeders are placed the greater will be the reactance, and hence the greater will be the voltage drop on the feeder. If, because of war restrictions, it is necessary to use open wiring, the installation should be made with the feeders as short as possible and placed as near together as electrical codes will permit.

There have been a number of instances where the use of open wiring for welding machines resulted in noisy radio reception and faulty functioning of other electrical apparatus in the immediate vicinity. Because of the standing electric waves setup on the open feeders, conduit wiring will eliminate or greatly reduce this interference. Certainly open wiring should not be installed in a factory located in an urban residential center. Originally, open wiring was used exclusively in many of the hurriedly constructed war plants throughout the country. However, because of interference between the welding machines themselves it later became necessary to change over to conduit wiring, with a consequent loss of time and production.

Because of its low voltage drop and low initial cost, a concentric cable (Fig. 8) has been designed for feeders to resistance welding machines. The two-conductor, concentric construction was selected primarily to improve voltage drop.

The two factors that govern cable selection are heating and voltage drop. With such cable, it is possible to make

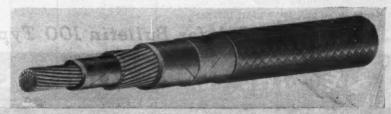
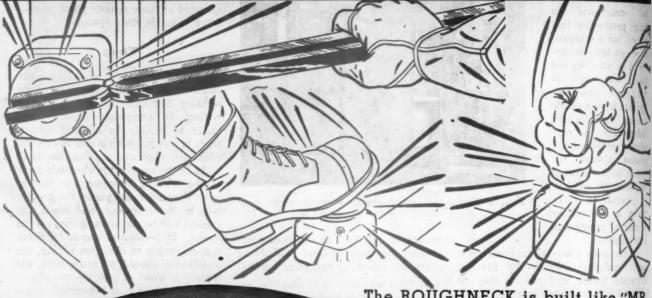


FIG. 8—Concentric cable of two conductors used for welder feeders because of low voltage drop and low initial cost.

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And if you miss the "button", those rounded sloping shoulders let the impact slide smoothly off.

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longer runs with substantial savings in

The customary step-by-step method of selecting conductor size is as follows:

1. Select the proper conductor size from Table 1 for the known "during weld" primary current and duty cycle. (The averaging time for determining the duty cycle should not exceed one minute.)

2. Check in Table 2 to determine whether the voltage drop at rated current will be satisfactory. Because a five percent voltage drop has been found to be an economical figure, Table 2 has been calculated on that basis. Hence, select the proper con-

ductor size from this table for the known "during-weld" current and distance from load to source of supply.

Use the larger-size of the two conductors as indicated by reference to Tables 1 and 2.

If a 220-volt supply is used, Table 1 will still apply for the selection of conductor size from the heating standpoint. However, in using Table 2, the actual distance from the supply transformer to the welder should be multiplied by two and the conductor size selected on that basis. For example, if the actual distance is 200 feet, the conductor should be determined by taking the size given under the 400-foot column in Table 2.



Feeder cable sizes for resistance welding machines for 440 vols, 60 cycle, single phase circuits. 85° C copper—40° C ambient. Cable in conduit.

During-weld current in amperes	Conductor Size (A.W.G. or MCM) Based on Heating				
	Duty Cycle—Per Cent				
	5	10	30	70	
100	8	8	6	2	
250	6	4	0	0000	
500	2	00	300	600	
750	00	250	600	1250	
1000	0000	400	1000	2500	
1500	400	750	2500	WELL AND WAY	
2000	700	1250	3 . 2 . 9	11	
2500	1000	2000	MARIE		
3000	1500	2300	5		
3500	2000	this, prinsus	do noitable	onni ent	
4000	2500	puboug un	vises A	is tope.	

TABLE 2

Feeder cable sizes for resistance welding machines for 440 volts, 60 cycle, single phase circuits. Cable in conduit.

During-weld current in amperes	Conductor size (A.W.G. or MCM) Based on 5 percent voltage drop in cable when load is applied* Distance in Feet from Supply Transformer to Welder						
	100	8	8	8	8	6 2 0	6
250	6	6	6	4		2	
500	2	2	2	2		00	
750	0	00	00	00	000	0000	
1000	0000	0000	0000	0000	0000	300	
1500	400	400	400	400	400	500	
2000	700	700	700	700	700	800	
2500	1000	1000	·1000	1000	1000	1250	
3000	1500	1500	1500	1500	1500	2000	
3500	2000	2000	2000	2000	2000	3000	

This voltage-drop table was prepared on the basis of a 30 to 40 percent power factor, which should cover nearly all cases except where power-factor-correction methods are used. For power factor outside his range, the voltage drop may exceed the 5 percent allowable drop and require the use of a larger conductor size.

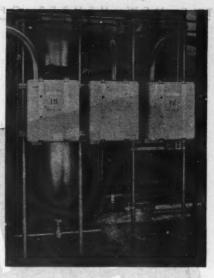


FIG. 9—Low-voltage air circuit breakers protect individual welders supplied by this 2300/460V, power transformer.

Welding machines demanding up to 100 amps. line current are usually protected with a fused knife-switch placed near the welding control. The larger machines, 100 amps. and up, should employ circuit breakers equipped with instantaneous trips that will promptly and safely intercept overcurrents or short-circuits (within the breaker rating), Fig. 9. The fused switch box, being a manually operated device should be mounted within reach of the operator. Circuit breakers are available in manually or electricallyoperated types. The electricallyoperated breaker is preferred, since it can be operated from a pushbutton station mounted on the welding machine while the breaker itself is mounted at some remote location.

The air type circuit breaker, with its instantaneous trip, will immediately interrupt the feed circuit upon failure of an ignitron power tube to function properly in a welding control. Incorrect operation of the control usually results in a d-c current component. This d-c current in turn saturates the iron core of the welding transformer resulting in instantaneous high a-c current transients. Under such conditions a fuse or a thermal relay and contactor may not open the feed circuit, as thermally operated devices are too slow to operate on instantaneous values of current. However, the instantaneous trip, when adjusted within the current rating of the ignitron tube, will open the breaker to protect the tubes upon the occurrence of dangerous over-currents occasioned by circumstances beyond the control of the welder operator. Manufacturers of circuit breakers can supply tables which will be helpful in selecting the proper size breakers for any welding installation.



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FIG. 10

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FIG. 10A—Water-cooled welding transfermer, showing series water connections.

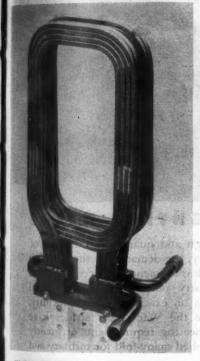


FIG. 10B—Secondary-coil assembly of water-cooled welding transformer.

A form of over-voltage protection should be used on power-factor-corrected installations where the capacitor units have a maximum permissible voltage rating which would be exceeded under short-circuit conditions (with the welder electrodes directly shorted). This equipment should automatically by-pass the capacitors under short-circuited conditions. When series capacitors are used with resistance welders having synchronous electronic control, it is necessary that a charge be left on the capacitors between successive welds. For this reason, a discharge resistor and confactor should be installed to discharge the capacitors totally when the equipment is shut down. Where either nonynchronous electronic control or nechanical contactors are used, the discharge resistor is permanently conlected across the capacitor bus.

To avoid interference problems and

also as a precautionary safety measure, all enclosures and frames should be grounded. The wiring diagrams for the control apparatus should be inspected to determine if any circuits are to be grounded. Long runs of conduit should be grounded at both ends. For small bench welders and machines up to 100 kva. rating, a stranded No. 2 (A.W.G.) wire may be used. On installations larger than 100 kva., 3/0 or 250 MCM wire should be used.

Cooling Water

The welding transformers on all resistance welding equipment except the smallest bench welders, are cooled by circulating water through the welding transformer secondary windings (Fig. 10A and 10B), and through the Because of the welding electrode. sharp bends and small orifice through which the water must pass, it is imperative that clean, clear water is used. On certain types of work, better welds and increased electrode-tip life will result if a refrigerant, instead of water, is circulated through the electrodes alone. This usually involves setting up a separate refrigerating unit near the welding machine, although on some of the newer equipments this unit is built into the welder frame.

All electronic resistance welding controls using ignitron power tubes also require cooling water to be circulated in the outer jacket of each tube. It is important to maintain the proper rate of flow as well as water temperature through these tubes. Table 3 lists the required flow as well as the maximum inlet and outlet temperatures for the most common classes of ignitron tubes. As in the case of the welding machine, clean clear water only should be used as a coolant. The process water of a factory is usually too warm during the summer for use in the ignitron tubes; its temperature should be checked with the figures shown in Table 3. For this reason, city or plant drinking water is generally used for cooling.

In plants using a large number of

welding machines, it is sometimes economical to install a reservoir circulating system instead of exhausting the cooling water into the sewer. If process water is to be used, a strainer should be installed at a point just before the water enters the control panel. This strainer should be cleaned frequently to prevent clogging which might reduce the rate of water flow.

Most all electronic welding controls employing ignitron tubes contain some form of water-interlock or flow-switch to insure the flow of water through the power tubes during welding. Two of the most common types are shown in Fig. 11A and 11B. Both of these types are thermal and require approximately one minute to operate after power is applied when water is not flowing. These thermal flow switches are constructed to insure the proper water temperature and flow. The thermal switch acts to prevent operation of the control when the rate of flow decreases or if the water temperature exceeds 40 deg. C.

There are several forms of pressure switches used to insure water flow. However, these do not respond to clogged outlets since even if the water does not flow, the pressure is maintained.

The length of water hose between the power tubes or a tube and metal water pipe should not be less than 24 inches in order to maintain the proper electrical clearances. To prevent air pockets, the cooling water should always enter the bottom of an ignitron tube and exhaust at the top.

Tubes

Electronic resistance welding control panels employ almost all classes of electronic tubes; phanotrons, thyratrons, ignitrons, glow tubes, and radio receiver type tubes. The smaller size tubes, such as the glow, receiver type, and some small thyratron tubes, require only the care given ordinary radio tubes. Certain equipments are shipped with these tubes mounted in their respective sockets and hence require no special treatment before they

TABLE 3

Tube Size (2 Tubes)	Minimum Water Required in Gol. per Min.	Maximum Water Temp. Outlet	**Approximate Maximum Inlet Water Temp.	
A		40°C/104°F	37°C/99°F	
B	1	40°C/104°F	35°C/95°F	
C	1-1/2	40°C/104°F	32°C/90°F	
D	3	*30°C/ 86°F	16°C/61°F	

* This maximum outlet temperature may be increased to 40°C with a reduction of 30 percent in the duty cycle for any specific current.

** The maximum allowable inlet temperature may be increased by increasing the water flow.



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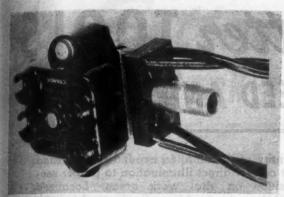


FIG. 11A-Heater type flow switch.

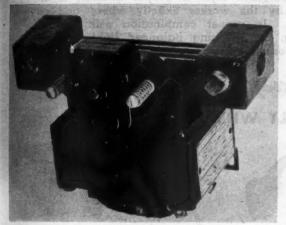


FIG. 11B-Transformer type flow switch.

are placed in operation. The large thyratrons, which are wrapped and shipped in separate cartons, should be placed in their respective sockets in accordance with the panel wiring diagram or marking on the panel.

When these tubes are first installed, they must be heated for at least 15 minutes, with the anode and grid caps removed, in order to permit the mercury to be evaporated from the tube elements. After this preliminary heating period, remove power and replace the caps. The control time-delay relay will give sufficient time for cathode heating for all subsequent operations of the control. If a new tube is inserted at any time, this 15-minute period of preliminary heating should be repeated. Ignitron power tubes should be carefully removed from the crates or boxes in which they are shipped and bolted to the bus supports in an upright position. Connect the anode lead to the proper stud or bus. If when installing, it is necessary to twist this braided lead, turn the lead in the direction required to unwind the braid since tightening may setup unnecessary stress in the glass anode seal. Be sure to connect the ignitor, which extends from the bottom of the tube, to the proper terminal as shown on the panel wiring diagram. Operators not familiar with metal ignitron tubes should be

cautioned that the outside jacket is at line potential when the main power switch is closed. Ignitron tubes do not require any conditioning before being used for welding operation.

Accurate records should be kept of all tubes in each control. This record will be a means of determining if the tube has met the warranty issued by the supplier. An example of a record card is shown in Fig. 12. A separate card should be kept for each tube socket in the panel and may be placed on a hook or in a rack in the control panel, or in a central file in the maintenance office for ready reference.

It is most advisable to have a convenient 115-volt, 60-cycle outlet near each welding machine or control. The purpose of the outlet may be threefold.

In case of trouble, it can be used as a source of power for a drop light or soldering iron. During welding it may be used for a spot or work light. And last, but most important, the cathode-ray oscilloscope requires a 115-volt, 60-cycle source of power for operation. In order to avoid problems of synchronization, it is important that the 115-volt power be obtained from the same power circuit as that used for the welder.

When cadmium or zinc-plated parts as well as leaded steels are to be welded, modern safety codes require that some form of fume collector be mounted near the welding electrodes. The possible poisonous gases emitted during the welding of these materials should be exhausted to the open air.

In welding installations where a variety of work is to be done, a good practice is to build a cabinet or rack to hold the various electrode tips. This should be mounted near the welder and locked when not in use, to prevent other operators from using the tips improperly.

Instruments

When using resistance welding machines, such as spot, projection, and seam welders, it is desirable to know the actual welding current, so that the data accumulated on one machine can

be used in connection with other machines and other materials. Also, knowing actual current values are often helpful in trouble-shooting thus facilitating proper maintenance. A pointer-stop ammeter is used for measuring welding currents of short duration.

The term "pointer-stop" has been applied to indicating instruments equipped with an adjustable pointer-stop (in addition to the stop, or stops at the scale end normally provided to prevent overtravel of the pointer). This pointer-stop may be adjusted by an external knob. In ammeters, this stop is arranged so as to push the pointer up-scale; while in the case of voltmeters, the setting is reversed.

The welding current can be determined, either by means of a point-stop ammeter connected to a suitably rated current transformer directly connected in the welding-transformer secondary circuit; or by measuring the primary current, and multiplying this by the ratio of transformation. latter method is usually preferred, since often it is inconvenient to install permanently a current transformer of adequate capacity in the secondary circuit. Figs. 3, 5, and 7 show paneltype pointer-stop ammeters permanently mounted at the welding control or machine.

The maintenance department should add the following instruments to its service equipment if quick and success[Continued on page 198]

TUBE RECORD CARD

PANEL NO. 10 TUBE NO. 3

TYPE NO. FG-95 es WL-632

REMARK

New tube installed-19/22/44
Neater burned out-2/14/45
(Temporarily replaced
with used tube)
New tube installed-3/1/45

FIG. 12—Tube record card such as this should be maintained for each tube socket.

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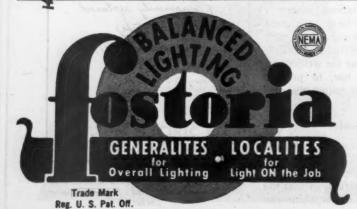


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How to Calculate Interrupting Capacity—I

A simple method for computing interrupting ratings of breakers and fuses for adequate protection against fault currents. The step-by-step procedure is well illustrated by example.

THE possibility of faults or shortcircuits in an electrical circuit requires interrupting devices of adequate capacity to clear the worst condition. Should the device be unable to interrupt this worst condition (short-circuit causing highest fault current), unwarranted damage to personnel and equipment and loss of ervice might easily result. In addition to adequate "IC" (interrupting capacity) to clear the circuits safely and quickly, the device must also have ficient momentary capacity to withstand the effects of the maximum short-circuit current which the circuit can develop.

Therefore, to select the proper interrupting devices, it is necessary only to know how to calculate these maximum currents under short-circuit condi-

First of all the ratings and reactances of all machines involved must be mown. Data on generators, transformers, and motors can be obtained from the manufacturers of the specific apparatus (approximate values are given in Tables I and II). The reactance of comparatively short connections, such as those between machines, transformers, and buses, usually need not be taken into account, but the reactance of feeder and distribution conductors generally must be considered.

STEP 1-To Find Total Reactance to Fault

(a) Reactance and Resistance Impedance, that quality of a circuit which impedes or restricts the flow of carrent, has two components, resistance and reactance. When one of these components exceeds the other by more than 3 to 1 ratio, the smaller can be neglected and the impedance taken to be the same as the larger. In a-c

By Wayman A. Holland Switchgear Division General Electric Company

circuits, especially in systems higher than 600 volts, the resistance is usually negligible and it is common practice to refer to reactance only. In low-voltage systems, 600 volts and below, especially in 208 wye/120 volt lighting systems, the resistance may be of appreciable value, and in such systems con-

siderable error may result if it is not included. Even though the resistance of the low voltage machine is generally negligible, the long leads and long circuit conductors have relatively. high resistance, and negligible reactance. Where these conditions exist, therefore, the impedance should be used rather than reactance only.

In this article and in the examples it is assumed that, with the exception of the 20-mile 69 kv. transmission lines, there are no long circuit conductors;

TABLE I

Approximate Reactance Values of A-C Generators and Motors, 3 phase, 60' cycle, 2300 volt and above.

	Subtransient Reactance Percent ²		Transient Reactance Percent ²	
	Range	- Mean ³	Range	Mean
Turbo-generators 1800 rpm 3600 rpm	10-17 7-13	13 10	Not used in normal short-circuit calculations	
Salient-pole generators (With Amortisseurs) Waterwheel-driven Engine-driven	20-35 15-30	25 20		
Condensers Air-cooled Hydrogen-cooled	18-30 21-35	25 30		
Synchronous Converters	15-35	20	20-50	25
Synchronous motors 720 rpm and above 600 rpm and below	10-20 20-35	17 30	15-35 20-50	25 40
Induction Motors	15-25	25		

In general: The reactance of 25-cycle machines will vary approximately 80 to 90 percent of average 60 cycle machines. There is little difference between 50 and 60 cycle machines.
² Percent based on machine kva. rating.
³ For close calculations specific data for the particular apparatus should be obtained. As is indicated under "Range", actual reactance values vary considerably from the "Mean."

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therefore only apparatus and transmission line reactance is used.

(b) "Percent" and "Per Unit"

It is common practice in a-c calculations to refer to reactance in percent. This means that a 12 percent reactance with rated current flowing through it causes a 12 percent drop in normal circuit voltage. In calculations, the percent value is written as a decimal value and is called "per unit". Thus a

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12 percent reactance, for example, becomes 0.12 per unit (p.u.) reactance. The greater the reactance the less the short-circuit current.

(c) Conversion to Base Kva.

In data giving percent or per unit reactance, the value is based on the kva. rating of the machine or circuit referred to. A given p.u. value, based on one kva. base will be different at any other. Consequently, before combining the reactances of a number of elements of a circuit, it is necessary to convert them to a common, or base kva. For this base kva., any convenient figure may be chosen. Usually it is the kva. rating of one of the machines in the system, or it can be the total kva. of the system, or part of the system.

Conversion is accomplished by dividing the base kva. by the kva. rating of the machine in question and multiplying the result by the given p.u. reactance value. Thus a 0.12 p.u. reactance of a 5000 kva. machine converted to a 10,000 kva. base is

 $10,000 \times 0.12 = 0.24$ 5000

(d) Conversion of Ohms to P.U. Sometimes, especially for cables, the reactance is given in ohms. This is changed to p.u. terms by the formula P.U. at base kva. = Base kva. × ohms (Kv.)² × 1000

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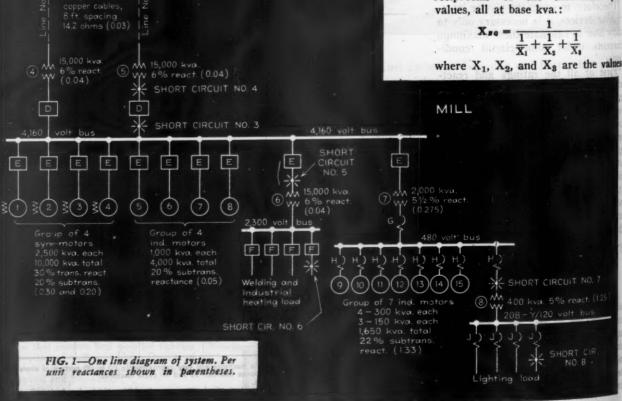
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· Example: Assume a 69 kv. transmission line with 18.75 ohms reactance, at 10,000 kva. base; P.U. at 10,000 kva.=

$$\frac{10,000 \times 18.75}{(69)^2 \times 1000} = 0.039$$

(e) Total reactance to Fault The p.u. values in series are added directly to obtain the total.

Where two or more generators, motors, or other circuits operate in parallel, their individual reactances must be combined into a single equivalent for adding to other reactances in series. This single equivalent is equal to the reciprocal of the sum of the reciprocals of the individual p.u. values, all at base kva.:



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Frequently an industrial plant is served by a power transformer fed by a system whose total reactance to the transformer is not known. If the system is large with respect to the transformer it is conservative to assume that the system will sustain its voltage when a fault occurs on the load side of the transformer and that the current is limited only by the reactance of the transformer.

Another procedure is to assume that the power circuit breaker controlling the transformer primary is properly and economically applied and that its interrupting rating is the limit of power available, with a p.u. reactance of unity (1.0). In such cases it is usually convenient to take the transformer kva. rating as the base. The unity reactance of the supply source then becomes simply the ratio of the transformer kva. divided by the kva. rating of the primary power circuit breaker. To get the total p.u. reactance to the transformer secondary terminals, this ratio, expressed as a decimal fraction, is simply added to the transformer p.u. reactance.

Example: A utility serves a plant through a 2000 kva. transformer, of 5½ percent (0.055 p.u.) reactance, controlled by a power circuit breaker having an interrupting rating of 250,000 kva.

The 1.0 p. u. reactance of the assumed 250,000 kva. utility capacity converts to:

$$\frac{2000 \times 1.0}{250,000} = 0.008$$

at the 2000 kva. base.

The total reactance to the transformer secondary terminals is then:

0.055 + 0.008 = 0.063STEP 2-To Find the Short-Circuit

Kva. and A-C Short-Circuit Current When reactance values are given in ohms, the current is found by dividing the volts by the ohms; but since per unit reactance is a function of kva., the short-circuit kva. value is found by dividing the base kva. by the total P.M. reactance. Thus, for the 2000 kva., 0.055 p.u. reactance transformer (480 volt, 2400 ampere) of the example in the preceding paragraph, the short-circuit kva., on the first assumption (of unlimited power), is $\frac{2000}{0.055}$ = 36,400 kva. Or on the second, (assumption that the available power is that of the primary breaker rating), $\overline{0.063} = 31,700$ kva.

The symmetrical short-circuit current (that is, the a-c component of the short-circuit current) in rms amperes, for three-phase circuits, is found by dividing the three-phase short-circuit TABLE II

Approximate Reactance Values of Distribution and Power Trans-

no content removed as more formers, 60 cycle grant gariquinatal cyn								
High Voltage Rating KV.	KVA. Rating	Approximate Reactance Percent ²						
DISTRIBUTION TRANSFORMERS — SINGLE PHASE								
2.4 to 4.8	100 or less 150 to 500	1.7 to 3.4 3.3 to 4.4						
6.9 to 13.8	100 or less 150 to 500	1.7 to 4.8 4.0 to 4.9						
22 to 33	500 or less 500 or less	4.1 to 5.5 5.5 to 7.5						
POWER TRANSFOR	MERS-SINGLE OR T	HREE PHASE						
2.2/3.8Y to 15 Above 15 to 25 Above 25 to 37	da la salar salar la salar salar la la salar salar	4.5 to 7 5.5 to 8 6.0 to 8						
Above 37 to 50 Above 50 to 73 Above 73 to 92	Above 500	6.5 to 9 7.0 to 10 7.5 to 10.5						
Above 92 to 115 Above 115 to 138 Above 138 to 161	Kva.	8 to 12 8.5 to 13 9 to 14						
Above 161 to 196 Above 196 to 230	coordinated averaged	10 to 15 11 to 16						

¹ For 25 cycle transformers reactances are approximately as follows: Distribution transformers,—80 percent of 60 cycle reactance. Power transformers—Approximately the same as the minimum value given for 60 cycle.
² Percent based on transformer kva. rating.
³ For three phase transformer use reactance of single phase transformer of one-third the rating of three phase transformer.

kva. by the circuit normal kv. times the square root of three:

$$Current = \frac{kva.}{1.73 \times kv.}$$

Motor Contributions: When short circuits occur, motors (both synchronous and induction) in operation from the same source become generators for the time being and add their contributions, equal in each case to the motor normal current divided by the motor p.u. reactance. Induction motor contributions are very short-lived. STEP 3-To Find Total Asymmetrical Short-circuit Current.

At the inception of the short-circuit, there is usually an "offset" component added to the a-c component of current of Step 2. This decays quite rapidly, but its addition to the a-c component of current makes up the total current which must be taken into account in the application of interrupting devices. The value of this total current is calculated by multiplying the a-c component of current by certain factors summarized in Table III and explained as follows:

(a) Fuses (15000 Volts and Below)

Where these are installed in circuits remote from a-c generators and station buses, the interrupting duty is found by multiplying the calculated a-c component of short-circuit current by 1.2. In this case "remote" means at a sufficient distance from the generator or substation bus that the ratio of the over-all reactance to the over-all resistance (X/R) does not exceed four. Under other conditions the multiplying factor should be 1.6.

NOTE: This is an exception to the statement that it is common practice in a-c calculations to refer to reactance only. In the case of fuses, if the resistance is less than one-fourth of the total reactance, the multiplying factor must be 1.6; otherwise, 1.2.

The motor contributions should be added before applying the multiplying factor.

(b) Low-voltage Air Circuit Breakers (600 Volts and Less)

The interrupting duty and momentary current duty of low-voltage air circuit breakers is found by multiplying the calculated a-c component short circuit current by 1.25. Momentary current ratings are numerically equal to the interrupting ratings.

In application, air circuit breakers should have interrupting ratings equal to or in excess of the calculated duty. For relatively large installations where there are many feeder circuits served from one or more sources of power it may be economically justifiable to use air circuit breakers in "cascade", which permits the application of suitably selected breakers for short-circuit currents in excess of their interrupting ratings. In this arrangement (see breakers G and H, Fig. 1) the breaker connected directly to the source of power must have full interrupting rating, equal at least to 1.25 times the calculated a-c component of the shortcircuit current. The second breaker in the cascade (such as H, in Fig. 1 for example), may be applied up to twice its interrupting rating, while a third breaker in the cascade (not shown in the example, Fig. 1) may be applied up to three times its interrupting rating. In such an arrangement the main breaker opens to assist the second and third breakers to interrupt shortcircuit currents in excess of 80 percent of their interrupting ratings. Cascade arrangements can be employed only with properly coordinated breakers, (with similar design features), and according to the recommendations of the manufacturer of the breakers.

(c) Power Circuit Breakers (Above 600 Volts)

The rated interrupting time of power circuit breakers most commonly used

is eight cycles, and for such breakers the multiplying factor for interrupting duty is 1.0.

In addition to the interrupting duty. power circuit breakers must have a momentary ability to withstand the total initial inrush current. For general cases the initial rms current is 1.6 times the calculated a-c component of current: but for circuits at 5000 volts and below, unless the circuit is fed predominantly by directly connected generators and other synchronous machines, or by synchronous machines through reactors only, the multiplying factor is 1.4.

Contributions from induction motors are neglected in figuring the interrupting duty of power circuit breakers, because these currents will have died down to an insignificant value by the time the power circuit breaker interrupts. These contributions from induction motors, however, must be taken into consideration in the computation of the a-c component before applying the multiplying factor to get the momentary current duty.

In the case of synchronous motors, the contributions for the interrupting duty are based on the motor transient reactance, while for momentary current duty the calculations are determined from subtransient reactance.

In the case of generators both the interrupting duty and momentary current duty are determined from subtransient reactance.

EXAMPLES

The following examples, with de-

tailed computations and explanations. illustrate the principles and methods described in the foregoing text.

A complete system for a large industrial plant, with generators, step-up transformers, transmission lines, stepdown transformers, synchronous motors, induction motors, lighting, heating and welding load is illustrated in Fig. 1. The percentage reactance of each unit is given at each machine, with the per unit reactance to the chosen base of 10,000 kva. shown in parentheses. Short circuits are assumed to occur separately at the points indicated, with calculations for the selection of circuit breakers with adequate ratings at locations A, B, C, etc. Per Unit Reactance Values

The first step is to convert all values of reactance to p.u. values at a common base, which in this case is taken as 10,000 kva.

Generator No. 1: 5000 kva., 8 per-

$$\frac{10,000 \times 0.08}{5000} = 0.16$$

Generator No. 2: 10,000 kva., 10 percent,

> Since this is the base kva. the p.u. reactance is 0.10

Generator No. 3: 15,000 kva., 11 5} percent (0.035 p.u.) read

$$\frac{10,000 \times 0.11}{15,000} = 0.073$$

Transformers, Nos. 1, 2, 4 and 5: 15,000 kva., 6 percent,

$$\frac{10,000 \times 0.06}{15,000} = 0.04$$

TABLE III

Multiplying Factors and Apparatus Reactances to Use For Interrupting Device Selection

or it, in this case remote forces of a sufficient or tanke about the generator or substitution. Was then the section	Multiplying Factor ¹		Reactances		
Interrupting Device	Inter- rupting Capacity	Momentary Current Capacity	Synchronous Generators	Synchronous Motors and Converters	Induction Machines
FUSES (15,000 volts and below, installed remote ² from generating station or substation bus)	1.2 (See note 2)	1.2 (See note 2)	Subtransient	Subtransient	Subtransient
LOW VOLTAGE AIR CIRCUIT BREAKERS	1.25	1.25	Subtransient	Subtransient	Subtransient
POWER CIRCUIT BREAKERS (8 cycle opening)	1.0	1.6 (See note 3)	Subtransient	(See note 4)	(See note 5)

¹ The a-c component of the short-circuit current calculated as explained in the text is to be multiplied by the factors given in this table for finding the required capacity of the interrupting devices to be selected.

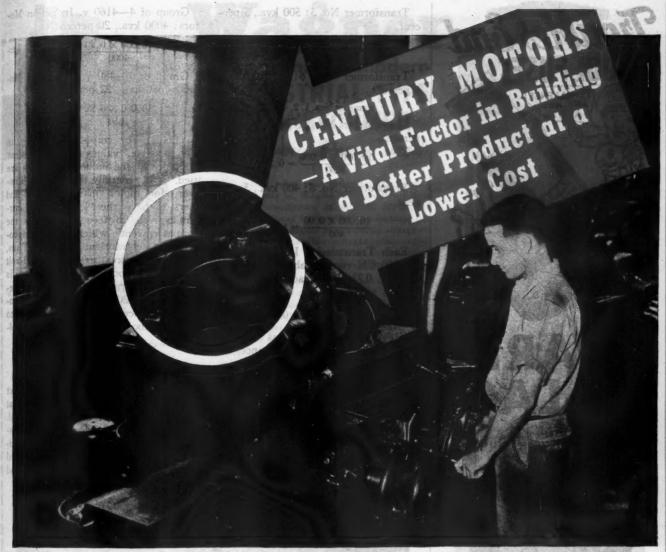
2 "Remote" means at sufficient distance from the generator or substation bus that the ratio of the overall reactance to the overall resistance does not exceed four. Under other conditions the multiplying factor should be 1.6.

3 This factor of 1.6 is for the general case for power circuit breakers. In circuits at 5,000 volts and below a factor of 1.4 can be used, unless current is fed predominantly by directly connected synchronous machines, or by synchronous machines, or by synchronous method in the fed predominantly of the following reactances should be used for power circuit breaker selection:

4 For synchronous motor and synchronous converter symmetrical short-circuit current contribution the following reactances should be used for power circuit breaker selection:

5 For the interrupting capacity.

5 For the interrupting capacity of power circuit breakers the short-circuit current contributions of induction machines are not considered, for calculating the momentary current capacity, the subtransient reactance is used.



Century $7\frac{1}{2}$ horsepower squirrel cage, totally enclosed, fan cooled motor driving a grinder.

ne of the vital factors in building better products at lower cost is the accuracy and dependability of the production machines—the lathes, grinders, drill presses, milling machines, boring machines, etc. There is where Century Motors aid in solving Industry's No. 1 Problem.

Century Motors' unusual freedom from vibration contributes to the accuracy of the machines they drive, resulting in higher quality of parts produced, fewer rejects, and greater production at lower cost.

Century Motors are today proving, and will continue to prove the sound value of such design features as—accurate machining and balance, rugged frames, extreme rigidity, accurately machined feet, end bumpers of unique design, and many others.

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Transformer No. 3: 500 kva., 5 percent.

 $\frac{10,000 \times 0.05}{500} = 1.0$

Transformer No. 6: 15,000 kva., 6 percent,

Same as Nos. 1, 2, 4 and 5: 0.04

Transformer No. 7: 2000 kva., 5½ percent,

 $\frac{10,000 \times 0.055}{2000} = 0.275$

Transformer No. 8: 400 kva., 5 percent,

 $\frac{10,000 \times 0.05}{400} = 1.25$

Each Transmission Line: 20 miles, 400,000 CM copper cable, 8 ft. phase-spacing, 0.71 ohms reactance per mile = 14.2 ohms,

 $\frac{10,000 \times 14.2}{(69)^2 \times 1000} = 0.03$

Group of 4 Synchronous Motors: 10,000 kva, transient reactance, 30 percent; subtransient, 20 percent.

Since the motor group kva. is the same as the base, these p.u. reactances are 0.3 and 0.2 respectively.

NOTE: The percent reactance of each group of motors, as a group, is given. This means that each separate motor has the given percent reactance, and consequently the percent reactance of the group is the same.

Group of 4-4160 v. Induction Motors: 4000 kva., 20 percent,

 $\frac{10,000 \times 0.20}{4000} = 0.5$

Group of 7-480 v. Induction Motors: 1650 kva., 22 percent,

 $\frac{10,000 \times 0.22}{1650} = 1.33$

NOTE: For consistency's sake, in this example, values of subtransient reactance of the induction motors are used. It is generally the custom, however, for motor manufacturers and users to have the "locked-rotor current" given, in terms of "times the normal current", which is the reciprocal of the subtransient reactance. Thus, for the 4000 kva. group of 4160-volt motors, the locker rotor current is five times normal, which is the reciprocal of 0.20 given as the subtransient reactance. This is converted into p.u. reactance at the base kva. as follows:

 $\frac{10,000}{4,000\times 5}=0.5$

In the concluding article next month, the short-circuit current at each point of fault will be calculated. Equivalent circuit diagrams will illustrate each calculation. Breaker capacities will be specified from the computed values for interrupting duty and momentary current duty.

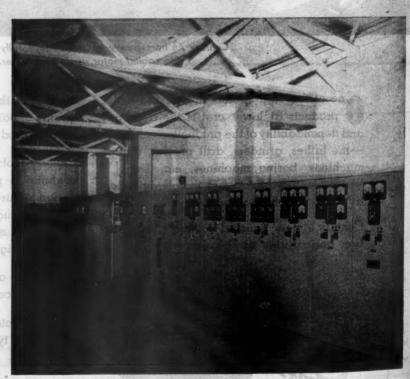


FIG. 2—Metal-clad switchgear of the type used in the Mill of Fig. 1. Note the metal-enclosed conductor runs from the transformers outside the building to the switchgear. Similar equipment is used in the Power-house at the supply end of the transmission line. Referring to Fig. 1, the breakers included in the complete bank of gear would be: the D breakers which feed the bus directly from the transformer secondary terminals, and all the E breakers.

Electric

200-kva, 2400- to 480-volt Noflamol transformer with industrial-type terminal chambers for both high- and low-voltage connections.

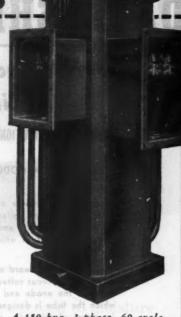


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Oil-filled, self-cooled transformers handle the largest loads with economy and efficiency. Noflamol transformers fill the need of a transformer containing a cooling and insulating liquid that retains the desirable characteristics of regular transformer oil but is noninflammable, thus giving safe dependable service installed in locations where regular oil-filled transformers would constitute a fire hazard.

These are, of course, only a few advantages of Wagner's complete line of transformers. Contact the nearest Wagner branch for consultation on transformer problems for your individual



A 150-kva, 3-phase, 60-cycle, 2400/4160Y- to 120/208Y-volt transformer equipped with a gang-operated G & W oil-fuse cutout on the highvoltage side and a low-voltage industrial-type terminal chamber.



Air-cooled transformer showing typical construction used for type AC, 10-kva and below, and type AA units through 25-kva.

This design provides a built-in junc-tion box with removable coverplate, and knockouts on sides and bottom for conduit or open wiring. Jumpproof banger lugs facilitate installation which can be indoors or outdoors.

> These Bulletins are Yours for the asking!

> > You should have the comprehensive trans-You should have the comprehensive transformer information available in Bulletins TU-180 (Distribution), TU-181 (Power), and TU-33 (Noflamol). Also ask for GU-82 on the complete line of Wagner products. Write for them today.



100-kva, single-phase, 60-cycle, 480- to 120/240-volt type AC air-cooled transformer. Fabricated sheet-steel case designed for indoor service only.

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Terms and Definitions Applicable to Electric Circuits and Electronic Tubes

7. ELECTRONIC TUBE DEFINITIONS AND CHARACTERISTICS (Con't)

C. MERCURY POOL CATHODE TUBE-IGNITRONS

a. Rectifier Service

- -Maximum peak inverse anode voltage is the highest rated instantaneous voltage that a tube can withstand between the anode and cathode in the direction opposite to that in which the tube is designed to carry current.
- -Maximum peak forward anode voltage is the highest rated instantaneous voltage that can safely be applied between the anode and cathode in the direction in which the tube is designed to pass current. Voltage in excess of this value may cause the tube to conduct without ignition current being passed through the ignitor. The operation of this tube under such conditions would be uncontrolled.
- —Maximum peak anode current*** is the highest instantaneous current that the tube is rated to carry recurrently in the direction of normal current flow at the given maximum anode voltage.
- —Maximum average anode current*** is the highest average current averaged over a time less than a given averaging time which a tube is rated to carry at the indicated maximum anode voltage.
- —Maximum surge anode current*** is the maximum instantaneous current that a tube will pass under the most adverse conditions without immediately being rendered inoperative.
- —Tube voltage drop*** is the anode to cathode potential drop when the tube is carrying current in the normal direction and averaged over the conducting period. It is a function of the anode current and the mercury temperature.
- —Maximum ignitor voltage required*** is the highest ignitor to cethode potential difference which is necessary to insure ignition in a time of the order of 100 microseconds.
- —Maximum ignitor voltage allowed*** is the highest ignitor to cathode potential difference that may be applied without damage to the ignitor or leads.
- —Maximum ignitor current required*** is the highest current necessary to pass through the ignitor to insure ignition in a time of the order of 100 microseconds.
- —Maximum ignitor current allowed*** is the highest current that the ignitor and leads can safely conduct to the mercury pool.
- -Maximum average ignitor current allowed*** is the highest average current that the ignitor and lead are designed to conduct to the mercury pool for the indicated maximum averaging time.

***These definitions for rectifier service also apply to the ignitron for welding applications.

b. Welding Service

— Maximum demand KVA is the product of the highest R.M.S. current drawn on full cycle operation of the welder and the R.M.S. line voltage.

- —Maximum average current at maximum demand is the highest average current which a tube is rated to conduct at the maximum demand KVA.
- -Maximum KVA at maximum average current is the highest demand KVA rating of a tube when conducting the maximum average anode current.
- —Maximum averaging time is the longest time over which the current should be averaged in calculating the average anode current regardless of the wave form or duty cycle.
- —Maximum current duration is the maximum time which a tube can conduct a given demand current without overheating or losing control. It cannot be repeated at a period less than the maximum averaging time.
- —Demand current denotes the R.M.S. current measured in the line between the pair of tubes and the welding machine.
- —Percent duty is the highest percentage of time that the tubes may conduct current during any time interval shorter than the maximum averaging time.

D. PHOTOTUBES-PHOTO-ELECTRIC EMISSION

- -Maximum anode voltage is the maximum instantaneous value of voltage that should be impressed on the tube. (This value is considerably lower for a gas filled than for vacuum phototube.)
- —Maximum anode current is the maximum instantaneous value of current that should be allowed to pass through the tube.
- —Gas ratio is the ratio of the current when the gas is ionized to the current due to the primary electrons alone or when the gas is not ionized. This term applies only to gas filled phototubes and is a measure of the gas and secondary emission amplification. The gas ratio is often taken as the ratio of the phototube current at 90 volts to that at 25 volts with constant illumination.
- Sensitivity of a phototube is defined as the amount of current that a tube will pass with an applied potential of 90 volts across the tube in series with a one megohm resistor when the amount of light falling on the cathode is one lumen. The sensitivity is usually given in microamperes per lumen.
- The lumen is a standard unit of light flux equivalent to a luminous intensity of one footcandle upon a projected area of one square foot.

E. METRIC SYSTEM PREFIXES

Kilo = 1000 or 1 x 10° (1 Kilowatt = 1000 watts)

Mega = 1,000,000 or 1 x 10° (1 megacycle = 1,000,000 cycles)

Milli = .001 or 1 x 10-0 (1 millivolt = .001 volt)

Micro = .000 001 or 1 x 10-4 (1 microhenry = .000 001

Micromicro = .000 000 000 001 or 1 x 10⁻³⁵ (1 micromicrofered = .000 000 000 001 fered)

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nderground cables for electrical distribution are exposed to moisture which can cause a lot of trouble and seriously interfere with service. Metallic sheaths will keep moisture out of the cables but they often create other problems of electrolysis, corrosion, sheath losses and maintenance. A flexible, non-metallic covering, such as a rubber sheath, that will not absorb water is the ideal protection.

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Metallic sheaths will keep moisture out of the

There's no doubt about it! Republic ELECTRUNITE stoub ni sorries bittorgrabate of reliant E.M.T. light weight, rigid steel conduit is the modern streamlined raceway for wiring.

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ELECTRUNITE E.M.T. is safe. It provides adequate electrical and mechanical protection as determined by the Underwriters' Laboratories. It is approved by the National Electrical Code for exposed, concealed or concrete slab construction.

Its uniform, tightly adherent coating of zinc offers continuous rust and corrosion protection-unbroken by threads . . . unmarred by vise or pipe wrench teeth.

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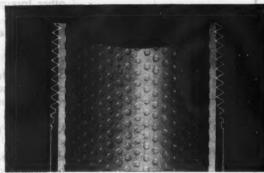
heak" and "arm-ache" out of installation, especially dem where runs are overhead, in shafts or in other difficult

uate Equally important, its uniformly high ductility combined with its freedom from excess weight makes EECTRUNITE E. M.T. easy to bend. With the patented ELECTRUNITE bender, predetermined bends can be made accurately and rapidly—in the shop or on the job.

for additional information see your local Republic ELECTRUNITE Distributor. If you do not know who he is, write or wire us for his name and address.

REPUBLIC STEEL CORPORATION THE AND TUBES DIVISION

1 25 CLEVELAND 8, OHIO port Department: Chrysler Building, New York 17, New York



Note the contrast between the wall thicknesses of ELECTRUNITE E. M.T. and ordinary threaded conduit. Because it is threadless, ELECTRUNITE E. M.T. does not require extra steel to act as a base for threads. Note, too, the patented knurled inside surface which makes wire pulling as much as 30% easier.



Two simple compression-type fittings—easily tightened by wrench or pliers—make firm, permanent, water-tight joints. No steel is exposed at joints—no wrench marks damage the zinc coating.



M-3

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Midget Electric Heater Inspection Schedule

Periodic inspection to keep existing equipment in obtain, scheduled preventive maintenance is a "must." first-class condition and prevent excessive and expensive maintenance is a wise policy to follow at any time. Today, when new equipment is difficult to

The schedule below applies to average conditions. If your conditions are unusual, greater frequency of inspection may be required.

IN- SPECTION PERIOD	WHAT TO	WHAT TO LOOK FOR	IN- SPECTION PERIOD	WHAT TO	WHAT TO LOOK FOR	
MONTHE Y	GENERAL Terminals*	Accumulation of moisture, dirt, acid, salt, or other foreign material. Make sure terminals are tight.	MONTHLY (Heavy oils and vege-table oils require more frequent inspection.)	D T 71 5	Oxides and foreign materials that float on the surface. Dross accumulation on neck of heater. Accumulation on bot- tom of tanks, such as scale, sludge, etc.	
MUNITAL		See that there is no pitting caused by corrosive action.	Andrew Towns of the Control of the C	AIR HEATERS— FAN-TYPE AND NATURAL-	and "armache" or	
charges of FLEC	Sheath or sur- face of heaters*	Make sure there is no electrolytic action on sheath of heater caused by grounds or stray currents.	miliani in dei	CIRCULATION Fans ngth times zzaaza mor	See that fans rotate freely in bearings. See that fan is tight on	
itt, Because it is quive extra strol and laureled ma 0% easile.	*Make a special inspec- tion of all new	Use milliammeter, mi- croammeter, or low	th the parent bends can for on the ju	Motor Pedietermined —in the shop	shaft. Oil motor at each in- spection. Check motor and switch mounting to make sure	
	installations after one week of operation.	cate stray currents.	ocal Repub not l YJHTNOM address.	see your K rateall	they are tight. Make sure it is clean (Accumulation of dust on heating elements re-	
Samueligis eliman atmin teletroria as elle espanish	IMMERSION HEATERS In Liquids	Deposits of oil sludge, scale, lime and other minerals found in water.	DRATIO	Back of Heater	duces efficiency of heater). Remove obstructions such as paper, etc., that have been sucked up against the back surface.	
	de	Accumulation on bottom of tanks, such as scale, sludge, etc.			Make sure heater is so located that free circulation of air is a lowed behind heater.	

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READER'S QUIZ

SYNCHRONOUS MOTOR FAILURE

UESTION 169-We operate a motor generator set. The a-c motor is 3-phase 2200 volt and exciter voltage is about 125 volt d-c. Recently one of our main 2200 volt power transformers blew up and the m.g. set stopped. When the spare transformer was cut in and the m.g. started, it burned one ring of the two collector rings very badly. It gradually became worse until we had to shut the place down in the middle of the afternoon. The machine was allowed to run till the brushes on this one ring no longer made contact due to being completely burned off. Then the main armature winding started to get pretty hot and finally began to smoke. Not until then were we allowed to stop the machine. What made the armature get hot and smoke as soon as the field quit? The p.f. went to 30 lag. The a-c amps. went around against the pin and the last figure there is 50 amps.-R.G.S.

TO QUESTION 169—The field has many turns, and unless it has a voltage limiter, such as a field discharge resistor across its terminals, it may get 50,000 volts or more d-c on opening the field circuit due to poor brush contact. In addition, the field can act as the secondary of a transformer and get a steady high voltage by transformer action.

The power factor dropped because upon losing the field the motor operated as a three-phase induction motor. The current increased in an attempt to supply its own excitation thus overheating the armature.—H.S.

TO QUESTION 169—It is not exactly clear why the burnout of the transformer and the use of the spare transformer should have caused the burning of the collector ring. Perhaps there may have been a

break in the field coil insulation caused by the strain when the primary disturbance occurred. When the burning continued and the field circuit was opened as a result of the brushes no longer making contact, you had no excitation in the synchronous motor field. The armature current then increased to provide the effective field excitation and balance the counter-emf (back voltage) in the armature. The result is a very much increased armature current at low (lagging) power factor. This increased current at low power factor does not produce more power. but does cause much more heating of the armature.-J.E.W.

REMOVING STATIC FROM FLOOR LINOLEUM

UESTION 170-In one of our chemical processes considerable quantities of ether are used and the resulting fumes present a serious explosion hazard in spite of the fact we have ample ventilation and the best of explosionproof wiring. Our problem revolves about the question of static electric charges that develop through the scuffing of many shoes on the linoleum floor covering. The answer is quite obvious for those persons who are permanent employees of the department-they wear shoes with conductive soles. It is the outside help that comes in for short periods that cannot all be required to wear special shoes. We plan on installing static grounding devices at the doors such as is common practice in explosive production plants; however, we do urgently need some information on the special type of floor dressings that are presumed to eliminate static charges. Can someone suggest a solution?-P. C. Z.

A TO QUESTION 170—If the regular employees in the de-

partment wearing conductive soled shoes present no static problem, the solution would appear to require visitors to use similar footwear. A special kind of overshoe is on the market. They look like a pair of ordinary rubbers and are worn over regular shoes. At the heel is a tee shaped strap of the same conductive material which is tied to the ankle above the weare's socks.

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Several pairs of assorted sizes could be kept outside the hazardous are and near the place visitors enter. It takes only a "jiffy" to put on or remove a pair. Visitors ordinarily to not resent the small trouble involved.

Leading rubber manufacturers make a conductive substance like sheets of linoleum which can be used for topping on the working tables. One brand has a number of fine copper wires embedded in the material. The wires are connected to the ground bus. Another gives good service merely by contact with the grounded metal edging on the tables.

When installing a conductive flooring, often a network of fine copper wire is placed on the subfloor. Then the top flooring is prepared from a powdered substance with much the same process of making concrete or plaster. A final top dressing of a black conductive paint is used.

Waxes used on floors will increase the contact resistance. One liquid war is on the market claiming to be conductive. It appears like any household wax except that it is quite black and has to be shaken before using. The writer has had no experience using this as a floor dressing, but he did successfully reduce static brush discharge by applying it to the driving belts of a machine.

A number of arbitrary tests are use to determine if the flooring or table covering is within the safe conducting limits. One uses an electrode of fire pound weights and five square inches of contact surface. A standard (for the factory) soap solution is applied at the contact surface just before making the test. Resistance is measured by a quid acting direct reading instrument, sur

Electrical Contracting, April 194

as a Megger or Megohmeter. If the resistance from ground to the contact surface does not exceed 250,000 ohms, the conductive material is said to be safe.—L. E. B.

A that electric charges can be built up in dry linoleum, as in many other dry dielectrics, by rubbing it, for instance by scuffing of shoes. This effect is not eliminated when the shoe soles are made of conductive rubber. In fact, static electricity can be built my in belts running over metallic pulleys. The hazard is eliminated by the dimination of the dielectric. Practically speaking, this means substitution of a conductive rubber, or conductive synthetic rubber matting for the linoleum in all hazardous rooms.—

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OPERATING INDUCTION WOTORS AT UN DER-VOLTAGE

UESTION 171. We have installed in an army camp laundry sixteen 1½ horsepower squirrel cage induction motors, each of which is direct connected for exhaust fan duty. The motors are 220 volt, 3-phase, 60 cycle. They are supplied with 3-phase, 208 volt, 60 cycle current. Will the supplied voltage damage the motors and what effect will it have on the slip and torque of the motors?—G. R. G.

A TO QUESTION 171. When a 220 volt motor is operated on 208 volts, it is operating at approximately 95 percent voltage.

The torque is proportional to the voltage squared which is in this case 95 squared or 90 percent of full load torque.

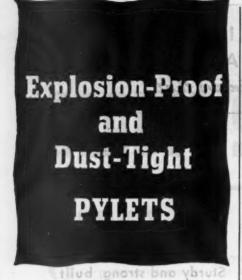
The slip is proportional to one divided by the voltage squared or 1/.95 squared which equals 112 percent meaning that the slip has increased 12 percent.

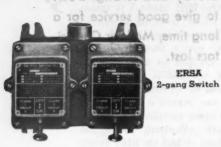
Since motors are built to operate on 10 percent increase or decrease in voltage, it is perfectly safe to operate the 220 volt motors on 208 volts.

The 208 volts suggests that the motors are being operated on a network system in which case the voltage sedom varies more than 4 or 5 percent from normal and the 220 volt motors would operate without harm should the line voltage drop 5 percent.

If the CFM delivery of the fans is satisfactory, it being less due to the increased motor slip, there is no cause for worry.









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While the foregoing applied to fan motors, I would be cautious about using a 220 volt motor on a 208 volt system to drive a compressor or the like due to the loss in starting torque.

—B. A. S.

TO QUESTION 171. Most a change in voltage of 10 percent will not damage the motor. Assuming the motor would not be overloaded at 220 volts, the installation should be OK on 208 volts. The current drawn by the motor will be about 6 percent higher. Slip will be slightly but very little higher. Torque will decrease as the square of the voltage, or will be (208/220)⁸ or 89.4 percent torque at 208 volts. However, in your case you would not be bothered, as you will still have plenty of torque to start the fans.—L. R. B.

TO QUESTION 171. If these 220 volt, 3 phase, 60 cycle motors are operated on a 208 volt, 3 phase, 60 cycle circuit, there will be some slight changes in the motor operating characteristics. Since motor torque varies as the square of the voltage, the starting torque and the maximum running torque of each motor when running on 208 volt will

be $\left(\frac{(208)}{(220)}\right)^2 = 89.6$ percent of what

it is when operating on 220 volts. Since the motors operate exhaust fans the required starting torque requirement is doubtless very low, also the torque at full load is steady in character with no peak loads so that this reduction in torque due to 208 volt operation will not be serious.

The slip of an induction motor varies inversely as the square of the voltage so that the slip on 208 volt will

be $\left(\frac{(220)}{(208)}\right)^2 = 1.12$ times the slip at

220 volts. However, the full load slip of the motor is very small as compared to the full load speed of the motor so that this will mean a very slight reduction in speed. For example, if the synchronous speed is 1800 rpm. and the full load speed on 220 volts is 1760 rpm. then the slip is 40 rpm. When operating on 208 volt, the slip becomes 40 times 1.12 = 44.5 rpm. and the full load speed becomes 1755.5 rpm., which is only a decrease in speed of 4.5 rpm. Of course, the amount of air delivered by the fan probably varies as some power of the speed so that even a slight decrease in motor speed may have considerable effect on the air delivery; but then again this decrease may be so slight as to be hardly noticed.

Beside torque and slip, the motor efficiency at full load and the starting



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orrent will show a slight decrease and the full load current, power factor and temperature will show a very slight increase.-R. F. E.

TO QUESTION 171. Viewed A from a sound and practical viewpoint the operation of 220 volt standard motors on 208 volt circuits is satisfactory and no disturbing factors may be expected.

This is a common practice in most plants and establishments having 120-208 volt, 3-phase, 4 wire, "wye" connected power systems because standard motors are designed to operate satisfactorily and without damage on voltage as much as 10 percent above or below the name-plate rating.

From a more technical standpoint, there are certain variations and the question may be more fully answered hy considering it thus. The starting and pullout torques will be in proportion to the square of the applied voltage. Since these motors are on fans which are centrifugal machines there will be no effect on the starting by a slight reduction in torque due to the low starting duty.

The slip will be slightly increased. For example, if the voltage were reduced 10 percent and the normal slip was 5 percent, the amount of slip would be increased to 6.05 percent.

Power factor will slightly increase and the efficiency and horsepower will be slightly decreased. This is of little consequence on small motors which do not ordinarily warrant special design.

TO QUESTION 171. Being in the Engineering Office of a Naval Air Station, using a 120/208 volt three-phase four wire system, we have the same problems as you have. The majority of our motors are 220 volt three phase. These motors have been in operation about three years and so far have caused no trouble.

A 220 volt motor when operating on 208 volts will take approximately 5½ percent more current than it will on a 220 volt system of the same load. As the limiting factor of any motor is the heating, due to the current flowing in it, the motor is actually reduced in capacity 51 percent. But as the averge motor seldom runs continuously at full load, and the 40° motor has considerable overload capacity, this slight drop in capacity has little effect unless the motor is run continuously at overlad or in a hot location.

The slip will increase slightly more on the low voltage as the motor must generate a lower counter-emf. to allow more current to flow in to get the necessary torque. As the speed decreases, the torque must increase to



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give the required hp.; so, as the torque is in proportion to the current, the current increases.

All these changes are usually too slight to have any serious effect on the operation of the motor.

The hp, of a fan varies with the square of the speed, so in your case I should expect the fans to run slightly slower and take about the same current.—A. E. T.

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TO QUESTION 171. Stand-• ard motors are guaranteed by the manufacturer to operate successfully at rated load and frequency with voltage not more than 10 percent above or below name-plate rating. Threephase, four wire, Y-connected distribution systems are common practice, supplying 120 volts for lighting and 208 volts for three-phase power loads. The nearest standard three-phase motor rating is 220 volts which is satisfactorily used on this system. Furthermore, in most cases the usual underloaded condition of motors allows them to operate, at reduced voltage, with at least as good characteristics as at full voltage.

For any load, the slip of an induction motor varies inversely as the square of the voltage. Hence, a 220 volt motor operating at 208 volts would have approximately 112 percent of normal slip.

The maximum torque varies directly with the square of the impressed voltage and in this particular case would be about 89.4 percent, which should prove very satisfactory for a low starting torque installation of this nature.—L. M. B.

REWINDING D-C ARMATURE

UESTION 172. Recently we rewound a 230 volt d-c armsine of a 25 hp. series wound hoist motor used on an overhead crane. When we placed it back in service it ran at approximately 1900 rpm. at no load. It should not have run over 1600 rpm. at no load and 510 rpm. under full load. It sparked excessively and ran very hot, finally throwing off the band wires which again made it necessary to take it out of service.

The armature has 40 slots, 19 bars and is wave wound. The coil pitch is 1 to 10 and the data as recorded shows the commutator pitch to be 1 to 42, which is the way it is connected. There are two turns per coil, wound two in hand, using No. 11 mag-

Electrical Contracting, April 1945

net wire. Evidently the trouble is in the armature for we replaced it with a spare and it ran all right, indicating that the fields are okay. Can anyone give me an answer as to what the trouble is?—F. F.

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To QUESTION 172. Obviously, the connection 1-42 is in error, as this connection gives a double re-entrant winding, resulting in the destructive speed mentioned. This connection reduces the number of active conductors in series by one-half, thus the armature must run at practically double its normal speed to generate a counter-emf. sufficient to oppose the line emf.

A four pole armature of 40 slots, two coils per slot 79 bars is usually connected 1-41 or 1-40, either connection will allow operation at normal voltage and speed but the 1-40 connection will give opposite rotation to the 1-41 connection. This armature will have one dummy or idle coil, which should have leads cut off well back of commutator and ends of leads properly taped.—H. R. L.

TO QUESTION 172. The trouble with F. F.'s motor is in the lead pitch, as motor ran opposite at double speed. It indicates a 4-circuit wave winding instead of standard 2-circuit. With 79 bars, 4 poles, lead pitch is $\pm \frac{1}{2}$. Thus the lead pitch can be 1 and 40 retrogressive or 1 and 41 progressive.

The 1 and 43 lead pitch forms a double wave winding progressive, as 1 and 43 puts lead of second coil on bar No. 3 instead of bar No. 2.

As rotation seemed okay, we can assume 1 and 41 okay. Line out should be from the center line of tooth between slots 5 and 6 onto bar No. 21 using dead coil for layout.

As motor heats, F. F. should check top and bottom lead pitch in reference to brush position to eliminate off center lead throw.—A. C. R.

A TO QUESTION 172. For a full spread, the coil side pitch may be determined by the formula:

$$Y_0 = \frac{S}{2P} = \frac{40}{4} = 10$$
 slots,

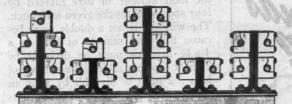
where Y. = coil side pitch

S = number of slots

P = number of pairs of poles

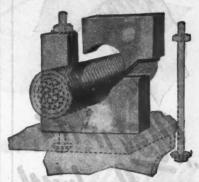
The coil side pitch should therefore be 1 and 11 for a full pitch. It is probable that the winding is chorded—90 percent pitch—resulting in a coil side pitch of 1 and 10. In any case, an error in this pitch would not be serious enough to cause the condition described.

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The given coil lead pitch would indicate that the motor has four poles. This assumption is based on the fact that the total number of bars divided by four approximates the given lead pitch. The winding is not a double wave because the total number of bars in a 4-pole machine must be divisible by 2; in a 6-pole machine, the number of bars ±2 must be divisible by 3; in an 8-pole machine, the number of bars ±2 must be divisible by 4. Furthermore, in a double winding, the brushes must be wide enough to cover two bars, or at least one and one half bars. This last item may be checked by inspection of the brushes.

The foregoing would indicate that the armature winding is single wave, in which the coil lead pitch satisfies the relation:

$$Y_s = \frac{B+1}{P} = \frac{79+1}{2} = 40 \text{ or } 39$$

which would result in a lead pitch of 1 and 41 for a progressive winding and 1 and 40 for a retrogressive winding. Evidently, therefore, an error was made in recording the coil lead pitch when stripping the armature. An error in lead pitch would allow the motor to run but it would spark. —R. G. C.

Can you ANSWER these QUESTIONS

QUESTION S7. We have a vertical milling machine the whole of which is magnetized. We have several voltages including both a-c and d-c available. What is a practical way of demagnetizing the machine?—L. L. B.

QUESTION T7. I have a 7½ horse-power, 3600 rpm motor that leaks oil out of the front bearing. It has sleeve bearings with an oil ring. I have had new bearings installed but this doesn't seem to help any. How can this trouble be overcome?—R. T. L.

QUESTION U7. We have a group of ten 1 hp. squirrel cage induction motors, 220 volts, 60 cycles, 3 phase 3400 rpm. After installation, one of these motors would lose speed as soon as the load was applied. We pulled this motor down and found the rotor had been throwing solder. I sent this rotor out to be tested and was told there was nothing wrong with it. I reinstalled the rotor, but it continued to lose speed. I would like to know if anyone has had similar experience and if there is any way I can test this rotor out of the motor. What materials could be used to repair same in case of emergency?—R.E.P.

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Electrical Contracting, April 1945

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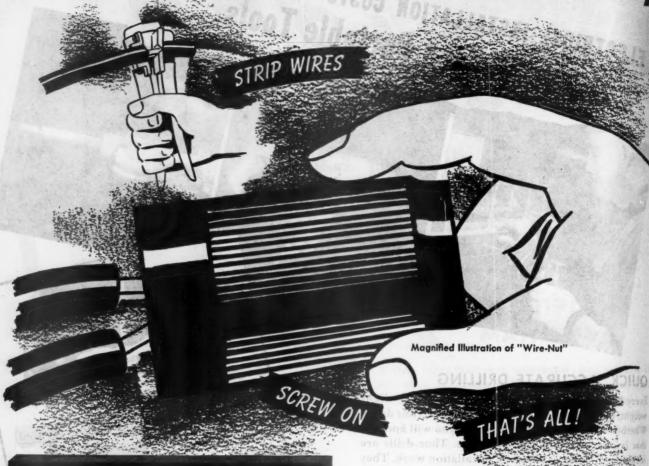
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MOTOR SHOPS

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Improving shop efficiency is the goal of every motor repair shop in the country. Men who work in these shops are always seeking ways to save time and still do a better job. Many develop their own ideas and put them into practice.

One such idea, which took second prize in the 1944 Award Contest of the National Industrial Service Association, was developed by W. C. Bedoit of the Chattanooga Armature Works, Chattanooga, Tennessee. It is a scheme for making quick and easy ground and rotor tests of polyphase motors.

The equipment, connected as outlined in the accompanying sketch, consists of a normally-open contactor, a step-up auto-transformer, a single-pole doublethrow switch and a pilot light. Incorporated in the motor testing switchboard, this dual-test arrangement provides a means of making a quick ground test (taking only a few seconds) on three-phase motors at three times their rated voltage while the motor is under test run. This is in addition to the regular ground test that each winder gives a completed winding before it is dipped and baked. Thus grounds incurred during assembly are revealed. The second use of this scheme is for a quick positive test of the squirrel cage rotor when the motor is at a standstill.

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On the "running" ground test, the step-up transformer is operated by the normally-open contact "A" (see sketch) which produces a voltage, equal to the step-up ratio of the autotransformer, between the flexible cable contact "B"—placed on the motor frame—and one phase of the motor winding. Switch "C" is on the "run"

position. Since the motor is running during this test, no change in line connections are necessary.

For the rotor test, the motor being checked is at a standstill. The stator is energized with 110-volt, 3-phase current through the magnetic switch. One line is interrupted by the single pole, double-throw switch "C" (see sketch). By placing this switch on the "test" position, pilot light "D" is energized by a voltage which varies according to the condition of the rotor. An open rotor bar is indicated by a flickering light which may even go out when the rotor is slowly turned by hand.

After proving their efficiency, these two simple tests have become standard practice in the shop of the Chattanooga Armature Works.

IMPROVED WIRE STRIPPER

With wire strippers employing wire brushes for the purpose, it is common practice to have the two parallel brushes mounted in a horizontal position. It is then rather awkward to hold the armature up in a position to feed the wire ends between the brushes and turn it at the same time.

H. R. Sweet, of Hoyt & Sweet, Los Angeles, has built a stripper that is very easy to manipulate. As seen in the picture, the parallel brushes are mounted vertically in a metal housing that is in turn mounted on the edge of the work bench. The brushes are revolved by means of a ½ hp. motor underneath the bench, using a V-belt drive. The housing enclosing the brushes has an extension to which is attached the nozzle of a vacuum cleaner assembly also located under the



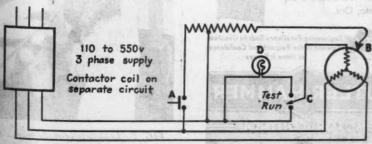
H. R. SWEET, Los Angeles, operates a self-feeding wire stripper which he built with brushes mounted vertically to facilitate manipulation.

bench. This draws off the waste as the stripper operates.

As will also be seen in the photograph, the armature is held low in front of the operator, where it is easiest to handle. With the end of the shaft against the housing, and having started with the proper length of strip, the brushes draw the wires through successively, practically a self-feeding operation, the shaft turning in the operator's hands.

GADGETS SPEED SMALL ARMATURE REPAIRS

The old expression "Necessity is the mother of invention" frequently portrays a complete story in its half dozen words. That there is not a single shop in this vast country of ours that has not, at one time or another, devised some gadget to facilitate its productive efforts, might be a fairly safe assumption. And that applies to both small and large organizations. From the ideas of shop men have come many of the tools and equipment now considered standard items.



SCHEMATIC DIAGRAM showing the connections for the dual-test set-up used in this Chattanooga motor service shop to quickly check rotors and grounds on three-phase motors. Ground test is made while motor is running.



Thanks to Cutler-Hammer engineers, modern cranes are operating on AC and getting DC performance. No longer must factories install expensive equipment for generating direct current. No longer must these plants install cranes equipped with mechanical load brakes.

Performance

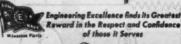
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With the new Cutler-Hammer AC Crane Control, complete load-control is at your finger-tips at all times. . . definite and selective speeds of hoisting and lowering; full dynamic braking; timed load acceleration and deceleration that fits the type of operation; accurate jogging that safely places even the most unwieldy load "on spot"... Switch.

This new Cutler-Hammer AC Crane Control can be used with any standard slip ring crane motor and is available in manual drum type and magnetic types. Insist on this unique engineering development for your next crane installation.

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Bench armature stand holds small drill armatures securely during winding operation. Sliding collar with thumb-screw adjustment provides the gripping force on shaft prongs. Rocker arm has several vertical adjustments.

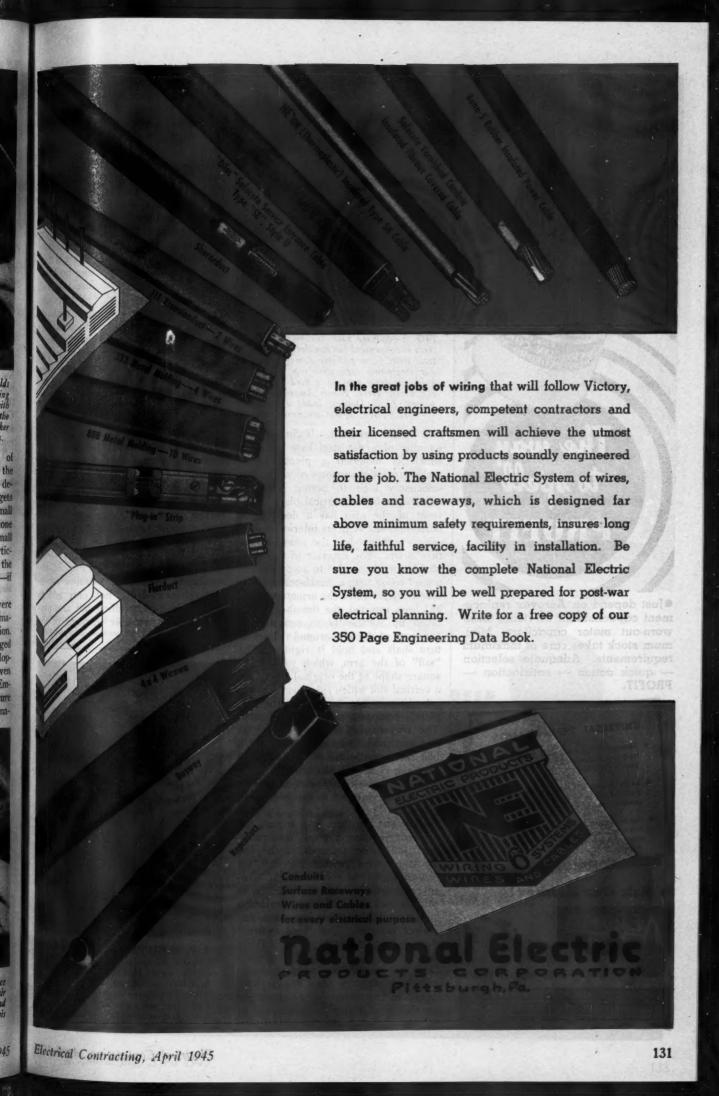
Down at the Texas Division of North American Aviation, Inc., the small portable electric tool repair department has devised a few gadgets that help speed the winding of small motor armatures. Such work is done by hand since the comparatively small volume and irregularity of this particular type of repair hardly justifies the use of fully automatic equipment-if such were available these days.

Conventional machinist's vises were first used to hold electric drill armatures during the rewinding operation. This soon led to numerous damaged threads and scored shafts-a development that made the repair job even more time consuming and costly. Employee's ingenuity entered the picture at this point and an adjustable arma-



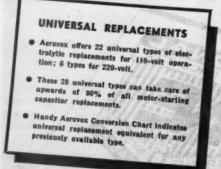
FIG. 2-Lead-twister made from a of fibre board and a spiral-twisted bair of stiff wires does a perfect job and saves thousands of man-hours for this chore alone.

Electric





•Just depend on Aerovox replacement capacitors for servicing those worn-out motor capacitors. Minimum stock takes care of maximum requirements. Adequate selection - quick action — satisfaction — PROFIT.



Ask Our Jobber!





FIG. 3—Storage rack for small armatures is convenient for bandling and protects units from possible damage. Similar single-row rack with top plate to hold armatures upright is used for baking units. Here, North American employee, L. F. Dooley, loads a storage rack with spare armatures.

ture holder was built. It consists essentially of a flat steel base plate on which is mounted a pivoted steel rocker arm, the supports of which are sufficiently high to permit adequate adjustment in the vertical plane. The front of the arm has a deep, wide horizontal slot with its interior drilled out to accommodate the round armature shafts. The exterior of this part of the arm is rounded to accommodate a steel collar with a thumb-screw pressure device. Once the armature shaft has been inserted, the thumb-screw is taken up sufficiently to squeeze the "prongs" of the arm around the armature shaft and hold it rigidly. The "tail" of the arm, which retains the square shape of the original stock, has a vertical slot which rides over a vertical adjusting bar (welded to the base plate) equipped with several holes. The rocker arm is held securely at any vertical adjustment by passing a bolt through the tail of the arm and the desired hole in the adjusting bar. The entire assembly can either be screwed or clamped to the bench top. (See Fig. 1)

Once the armature was wound, the problem of doing a good "lead twisting" job arose (strands of the fine armature wire twisted together for connection to the commutator). Another employee, not satisfied with using a nail or wood stick, devised a gadget to do this chore in a quick and perfect manner. The "lead twister" consists of two 4-inch pieces of fairly stiff wire "spiral-twisted" together. Over this twisted pair is placed a twoinch long piece of fibre (about 3-in. wide) in the center of which is cut an oblong slot just large enough to fit the wire so snugly that it will turn

or rotate if pushed along the length of the wire. The action is similar to the familiar toy made up of a thin metal propeller, a metal collar, and a length of twisted-pair wire. By sliding the collar along the wire, the propelle started rotating and would whirl of into space. Each end of the lead twister has a 90-degree hook. One of these hooks is placed in the loop of the armature leads, the fibre bar (down near the armature) held rigidly and pulled toward the operator causing the wire to rotate and twist the armature leads perfectly. The gadget is then turned around and the other hook engaged in a looped armature lead and the process repeated. Net result: armature leads are now perfecting twisted (see Fig. 2) and time savings add up to thousands of man-hours.

When dipped and ready for baking the armatures are placed in a rad made from a wood block, 2 in. by 4 in. with vertical holes to accommodate the armature shafts. The holes are drilled far enough apart to permit free circulation of heat around the armature A flat fibre or steel template, with holes to match those of the rack, i placed over the armature shafts (top) to keep the units in an upright position during the baking process.

The same principle is used for storage purposes, except the block is equipped with three rows of holes; two being on a bevel and one in the center. Blocks of this type (see Fig. 3), designed to hold 36 armatures for 1 inch electric drills, not only add to convenience of handling but also protect against possible damage of the units.

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miniature depression awaits the eletrical construction industry immediate after the war — unless something done. His answer: Rewire all build

A. J. McGIVERN, managing director, Chicago Electrical Wholesalers Asso-ciation, warns Illinois Inspectors that a to modern adequacy standards.

Fluorescent CURTISTRIP

Ideal for
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BENCH LIGHTING
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A MULTITUDE OF
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Practical, good-looking, sturdy . . . here is by long odds the best continuous wireway fluorescent unit for single lamp industrial installations.

CurtiStrip is a self-contained unit which is available in three reflector designs . . . giving the contractor a single unit which has sufficient modifications to work out a great variety of difficult lighting problems.

Curtistrip Deep Reflector Units are designed for general lighting or localized direct lighting over work benches, etc. . . . the Shallow Reflector Units provide a wider spread of lighting and are found ideal for local lighting when mounted below-eye-level . . . the third type is provided with an Asymmetric reflector which directs the light to one side, making an ideal unit for cove applications or for illuminating sleping and vertical surfaces such as panel boards.

Many special jobs can readily be worked out since reflectors can be put on channel on any spacing and convenience outlets spotted in as desired.

On all units the reflector surfaces are finished with the exclusive Curis Fluracite, a tough, extremely white reflecting surface having high resistance to discoloration and making maintenance and cleanliness a simple and low-cost procedure.

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MODERN LIGHTING

PISTON INSPECTION UNDER FLUORESCENTS

The manufacture of the huge engines that constitute the power plant of the B-29 super-bomber embodies, for the most part, precision work. Careful inspection of the component parts along the production line is a highly important phase of the process. Defective parts are discovered and discarded all along the line. When the completed engine passes its final test run it is a perfect mechanism commanding the faith of the pilots who fly the ships.

To assure the best inspection results, Chrysler Corporation's Dodge-Chicago Plant, where numerous engines roll off the assembly lines daily, uses high intensity fluorescent lighting at its inspection stations. Typical of these installations is the lighting on the piston inspection tables, where the final checkup is made before the pistons pass on to the assembly department.

Localized lighting is used in this area. Industrial type fluorescent units are employed, each fixture containing two, 100-watt, 3,500 degree white lamps. The units are mounted 27 inches above the table surface and spaced 18 inches between ends of reflectors. The fixtures are mounted to wood supports resting on table-top standards.

All units are plug-connected to con-



duit fitting receptacles to facilitate quick replacement should a unit fail. A new fixture is substituted for the burned out one while repairs are made so continuity of high level lighting is always maintained.

The illumination intensity varies from 150 footcandles directly under the units to 60 footcandles at the extreme edge of the table. Average intensity over the normal working area of the table is approximately 85 footcandles. Net result is a better inspection job.

RENOVATION OF CLASSROOMS in Shades-Cahaba School, Birmingham, Alabama, included new Venetian blinds, painting, rewiring, germicidal units and continuous row fluorescent lighting. Resultant illumination is 20 to 35 footcandles.

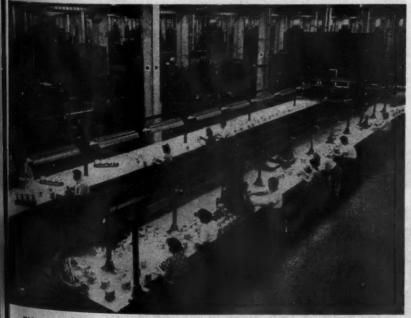
SCHOOL RELIGHTS WITH CONTINUOUS ROW FLUORESCENT

An outstanding school lighting job employing fluorescent fixtures throughout, germicidal lamps in the elementary rooms, installation of Venetian blinds, and redecoration of walls and ceilings was recently completed in Shades-Cahaba School in Birmingham, Alabama.

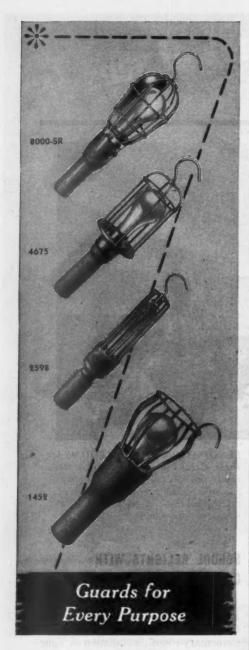
The building is both elementary and high school with 25 classrooms, auditorium, library, lunchroom, and offices. It had been allowed to run down with the result that the old lighting system provided not more than two to four footcandles of unevenly distributed illumination.

The new fluorescent system provides 20 to 35 footcandles of light, well distributed through the rooms. Two rows of ceiling type fixtures, mounted end to end, are provided for each room with six or seven sections per row, depending on the size of the rooms. Each unit is equipped with 48-inch, 40-watt white fluorescent lamps.

The installation of germicidal lamps consists of four units per room, each unit equipped with a GE Uviare 30-watt lamp mounted about seven feet



ENGINE PISTONS for B-29 bombers undergo final inspection on these benches flooded with 85 footcandles (average) of fluorescent illumination.



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Portable Guards save time, help to eliminate mistakes and spoilage and reduce eye-strain and fatigue. Lamp breakage is also reduced. Built to withstand hard usage, they last a long time and pay for themselves many times over. Ask your electrical wholesaler or write us for complete information on McGILL Guards. There is a type to fit every requirement.

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from the floor. These lamps provide a disinfection of the atmosphere of the room equivalent to 60 changes of air per hour. The air change in the average classroom is only seven per hour for the winter months.

The lighting is controlled by two switches, one for the row nearest the windows and one for the inside row. Thus the row nearest the windows may be cut off if not needed. A separate switch also controls the germicidal Additional convenience outlamps. lets in each room take care of such visual education aids as motion picture and sound equipment.

Fluorescent lighting units for all 27 classrooms and the library totaled 324 "Grenadier" fixtures by Wakefield with two 40-watt lamps in each. These fixtures have louvered bottoms and plastic side panels. Conditions in the laboratories and auditorium were such as called for the Wakefield "Commodore" units. Corridor lighting was supplemented by installing such old

units, taken from the classrooms.

The building was rewired through out in order to insure proper cape ity and regulated voltage. Use of the continuous "Grenadier" reduced wi ing considerably, the wiring being ru along as an integral part of the five tures. This made a minimum number of ceiling outlets necessary, probably not more than one-third as many as i previous types of lighting.

The wiring system is of 3-wire, 115. 230 volt secondary distribution type fed from a 2,300 volt primary. There are four 24-circuit and two 16 circuit distribution panels with an entrance capacity of 600 amperes.

In redecorating the rooms to provide the best seeing conditions, ceilings were painted a flat white with approximately 85 percent reflecting value and walls and blinds were finished in a light pastel green with an initial reflecting factor of 55 percent. The door and window trim is a slightly darker semi-gloss green.

INSPECTION LIGHTING BY MERCURY

High-level inspection lighting is provided by a combination of the new Westinghouse 3000 watt mercury lamps with 1000 watt incandescent bulbs for color correction. The installation shown by the accompanying illustration was made in the slab inspection area of the plate mill at Geneva Steel Company's plant in Geneva, Utah.

The three kw. mercury tubes are placed in open-end porcelain enameled reflectors while the 1000 watt incandescent lamps are used in high-bay

fixtures. Thirty mercury units are used to illuminate the inspection area and are hung by rod hangers from the steel truss chords to a mounting height of 42 feet above the floor. Two parallel rows of mercury units run down the high-bay area on 28 foot centers with individual units spaced 25 feet apart.

To obtain a satisfactory degree of color correction, the 1000 watt incandescent units are installed in two alternate rows with the individual fixtures also mounted on 25-foot centers.

The average resultant illumination on the working plane is 50 footcandes of well diffused, color-corrected light



COMBINATION LIGHTING which consists of three kw. mercury and 1000 watt incandescent lamps provides 50 footcandles of color-corrected illumination for slab inspection. Workman in foreground is "scarfing" a slab to remove surface imperfections.

Electrical



Electrical Contracting, April 1945

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YOU START HERE ...

...for peak
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Electrical Contracting, April 196

Electric



Westinghouse PLANTS IN 25 CITIES ... OFFICES EVERYWHERE

MAZDA LAMPS FOR SEE-ABILITY

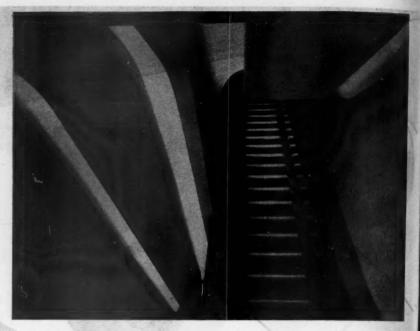


Low-Cost BLACKHAWK Pipe Bender has EVERYTHING!

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- PORTABLE
- ONE-MAN OPERATION
- ON-THE-JOB ACTION
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 FROM 1" TO 4"

You bet! — and Blackhawk Hydraulic Pipe Benders operate at any angle — avoid kinking, save need for heating or cutting and threading and use of elbows and couplings. Compact 10 or 20-ton ram and big range of attachments also handle many other bend, straighten, press, push, pull, spread and clamp jobs.





DIFFUSED ILLUMINATION from reverse coves using cold cathode fluorescent tubing lights escalators in Hutzler Bros. department store, Baltimore, Md.

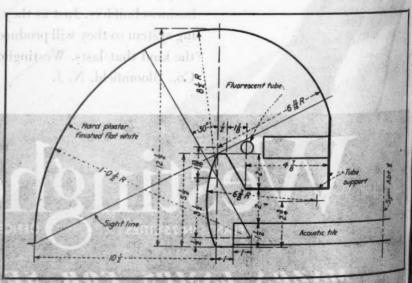
COLD CATHODE ESCALATOR LIGHTING

The flexibility of cold cathode fluorescent tubing makes it admirably suited to the lighting of escalators. An excellent example of this flexibility is the installation in Hutzler Brothers Department Store, Baltimore, Maryland. Here the architect, James R. Edmunds, Jr., has made lighting a part of the architectural treatment by providing two reverse coves in the ceiling over the escalators. These coves not only furnish an intensity of over five foot-candles of well diffused illumination, but also provide a directional effect for traffic flow.

Each cove is equipped with a 15 mm. 3500° white fluorescent tube tailored

to length and curvature to fit the cove, and is operated at 30 ma. Cold cathode tubing installed in 1938 in this store is still in operation. Long tube life and flexibility of design to provide a desirable architectural effect were factors influencing the selection of this type of light source for this application.

The design of the reverse coves in this installation were carefully worked out so that the light source is shielded from view, the interior surface of the cove is evenly lighted, and the total light produced is efficiently utilized. The successful application of these criteria to the design of other architectural lighting elements in this store contribute to the artistic and decorative treatment throughout.



DETAIL OF REVERSE COVE showing dimensions, curvature of cove, location of cold cathode tubing, and sight line.

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PAINE ANCHORS DEFY SHOCK • STRESS and VIBRATION

Place Paine Lead Expansion anchor in hole, tap with setting tool and tighten for permanent, safe anchorage in masonry and concrete. Eliminates time and labor wasting call-backs. Precision threaded and rust resistant.

900—Machine Screw Type—available in 9 standard diameters from 6-32 to 5%".

910—Bolt and Nut Type—available in 1/4", 3/8", 1/2" diams. in standard lengths.

911-for extra heavy an-







PAINE DRILL BITS



Drill anchor holes with Paine Carboloy Tipped Drill Bits. They cut masonry and concrete 50 to 75% faster . . . assure clean, round, accurately-sized holes . . . prevent fractured surfaces and eliminate noisy pounding. Can be used in any rotary drill (slow speed). Available in sizes 3/16 through 11/4" diams. (graduated in 1/16" sizes).

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FASTENING DEVICES



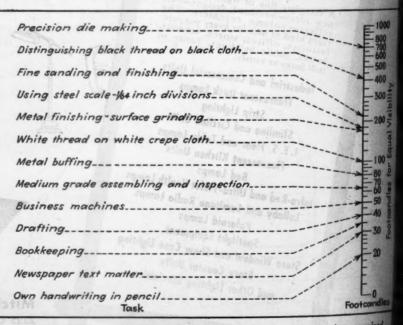
HIGH INTENSITY LIGHTING of task for equal seeing visibility is obtained at United Engineering Company's San Francisco plant with 150 watt shielded adjustable units.

LIGHTING IN INDUSTRY EQUAL VISIBILITY

For precision machines such experts as Luckiesh and Moss have said that illumination levels can be as high as 700 footcandles in order to be as visible as eight-point Bodoni type under uniform illumination of 10 footcandles. In a machine shop such levels are difficult to attain and still keep the brightness ratios in line.

However, at the United Engineering Co., San Francisco, Star Delta Electric Works, electrical contractors, and C. W. Macy, lighting engineer for Pacific Gas and Electric Co., worked

out a happy solution. General illumination in the plant is about 30 to 40 footcandles from high bay incandes cent units of 1,500 watts combined with two-lamp, 48-in. industrial fluo rescent fixtures and 60-in, industria fluorescent fixtures. But the real punc on the precision work itself is sup from a special local lighting unit containing a 150-watt reflector spot lam in a louvered metal housing which pre vents glare and keeps the housing co This builds up intensities of around 2 to 700 footcandles depending on the distance of the unit from the work an retains an approximate 10 to 1 ratio of brightness.



LOGARITHMIC FOOTCANDLE SCALE indicating illumination required on various visual tasks for equal visibility with 8-point Bodoni book type under uniform illumination of 10 footcandles. (From reports by Luckiesh and Moss)

Normal vision and a fixation-distance of 14 inches are assumed.

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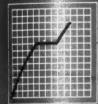
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1/10 TO 100 HORSEPOWER Pive types of gearhead motor have reduction ratios ranging up RIGHT COUNTY OF THE STATE OF TH

available in combinations of all these types

DELLE CAGE



HIGH EFFICIENCY

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Nore efficient than other type of slow speed drives only 2% power loss to sech stage of reduction, in



These are the **good reasons why** gearhead motors met with such immediate success when The Master Electric Company originated and pioneered the first line of gearhead motors, years ago.

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The complete Gearhead Motor is designed and built by one manufacturer in one plant.



integral, compact design saves space, saves money, improves appearance.



"Material Spoilage Was Greatly Reduced When We Installed BUSS FUSES

In Our Heat Treating Furnace Circuits"

-Mr. John Burchfield,
General Maintenance Supt.,
Iron Fireman Manufacturing Corp.



Why BUSS Fuses greatly reduce or entirely prevent needless blows

The fuse case is designed to insure good contact on the link, even when the fuse is renewed by an inexperienced person—and it is so designed that vibration or heavy overloads or the constant heating and cooling of the fuse will not permit poor contact to develop. Thus excessive heating, which causes fuses to blow needlessly, is prevented.

The fuse link used is the famous "BUSS Super-Lag." It has lag-plates attached to it. These give it a time-lag so long that it will reduce to an extent not possible with any other renewable fuse, the number of shutdowns caused by needless fuse blows.

Prevent future trouble in your plant - by doing this today

Pass the word along that all purchase records dealing with circuit protective devices should be immediately changed to call for BUSS Super-Lag Renewable fuses. Then, as fuses are replaced or new installations made, your plant will automatically get the benefit of the carefree, trouble-proof protection that BUSS Super-Lag fuses afford.

BUSSMANN MFG. CO., ST. LOUIS 7, MO.

Division McGraw Electric Company



Why BUSS Fuses Don't Blow Needlessly



10 FEATURES

in the design of the FUSE-CASE help make it possible



The SUPER-LAG

development in the FUSE-LINK completes the job.



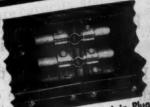
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FOR EFFICIENT POWER DISTRIBUTION



Square D Saflex Feeder Duct is designed to serve as the feeder between transformer banks and main switch-board or as feeders to branch circuits where minimum voltage loss is essential. Because of its low reactance and consequent balanced low voltage drop (1.8 volts and consequent balanced low voltage drop (1.8 volts per 100 feet) it is ideally suited for welder circuits—enables conductor size to be kept at a minimum. Feeder duct is available in standard 10-foot sections with special fittings to meet all types of installations. WPB sizes of 800, 1000, 1350 and 2000 ampere capacities.

Square D Plug-In Duct is a perfect running mate for Feeder Duct. It permits plugging-in machines whenever and wherever they are needed. Units are easily attached and disconnected. 100% salvage for re-use. Available in 250, 400 and 600 ampere capacities.



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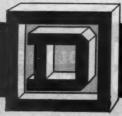
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Electric

Flexible Couplings join PlugIn-Duct bus bars. Special design permits expansion or contraction to be absorbed at the
joint, and also provides flexible connections for correction
of minor variations in bus alignment. Notice use of round tubular buses which afford highest
possible mechanical strength
when subjected to heavy short
circuit stresses.



Units Easy to Attech. How type bracket on top of plugity of the total unit attaches to top of dust unit is then swung down as lower to the total unit is then swung down as lower to the total unit of the total unit of the total units may be attached to each 10' section.



SQUARE D COMPANY

DETROIT

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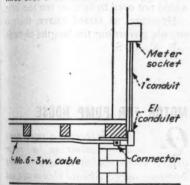
LOS ANGELES

QUESTIONS ON THE CODE

STRIPPING CABLE

Q. "Would the individual conductors of nonmetallic cable be approved for conduit installation?

"Would it be permissible, on the load side of meter, as shown, to use three No. 6 conductors in a short run



of 1 inch conduit with an "L" condulet according to exceptions shown for Table 4 of the National Code?

"The plan is to bring No. 6 non-metallic sheathed cable under building to the "L" condulet where it will be secured by a connector. At the "L" the outer braid will be stripped off and the three conductors run through 1 inch conduit to the socket."—E.J.M.

A. No, the above treatment and use of nonmetallic cable would not comply with the National Electrical Code requirements.

If the outer covering was removed, the paper, jute and other filling would naturally come off leaving a single braid rubber covered wire, the braid of which would not be flame-retardant. Here, there are two conditions which do not comply with the Code, viz: single braid instead of the two required for No. 6 wire and the lack of flame-retardant on the braid.

If protection against mechanical injury to the nonmetallic sheathed cable is required or is desired, then a 2 inch conduit could be used into which the finished cable could be pulled. As the cable has an outside diameter of about 1.1 inch, the area of the cross section is about .95 square inches and the smallest sized conduit to take this would be 2 inch.

Please note that we are answering only the question asked and are not mentioning anything about the propriety of attaching the cable to the underside of the floor beams as indicated on the sketch and which we believe to be unsafe.—F.N.M.S.

OUTLET BOXES

Q. "Is it true that boxes must be used at every outlet on an open knob and tube wiring installation?"—H.E.

No. Section 3014 of the National Electrical Code answers your question as follows: "A box shall be installed at each outlet, switch or junction point of conduit, electrical metallic tubing, surface metal raceway, armored cable or nonmetallic sheathed cable and at each outlet and switch point of concealed knob and tube work." The fact that open or exposed knob and tube installations are not included indicates that boxes are not required by the Code on such installations.—G.R.

WIRING SHOWCASES

Why do showcases carry the label of the Underwriters' Laboratories, Incorporated, but have raceways consisting of thin wall tubing smaller than ½ inch. An article appearing under this heading in the January issue stated that a contractor should not install a raceway smaller than ½ inch in any showcase?"—G.J.P.

This is an excellent question. A manufacturer of showcases or any other type of wired appliances who plans on obtaining the approval of the Underwriters' Laboratories, Incorporated, for his product may obtain permission to use raceways smaller than the regular trade sizes providing actual examination and tests conducted by the Laboratories indicate that such

raceways may safely be used within his particular product. Actually this simmers down to the fact that a contractor in the field cannot be expected to have the facilities for duplicating the varied approved products now in use, and for that reason the National Electrical Code limits the use of tubing smaller than ½ inch to underplaster extensions and for enclosing leads of fractional hp. motors.

The manufacturer can provide special tools and machinery for the manufacture of his product, and in many cases the entire wiring of an appliance or device may be completely assembled as a wiring harness and then incorporated with the final product during its actual construction making it possible to accomplish many things that could never be duplicated in the field without an excessive expenditure of time and money. Then too, articles bearing the UL label of approval are constructed in accordance with specifications covering not only materials used but also their application, and samples are checked periodically by trained engineers to assure continued compliance with the specifications. If each contractor were permitted to use a raceway of his own choosing this same rigid inspection could not be duplicated by local inspection authorities as they do not have the necessary facilities at their disposal nor the time required to conduct proper test.-G.R.

LENGTH OF PORTABLE CORDS

where in the Code it states the length of cord to appliances and lamps should be six feet from receptacles or where vacuum cleaners and portables can have 25 foot lengths. Can you supply data specifying the permissible lengths for the different usage and safe handling of these appliances?"—G.H.B.

The National Electrical Code does not regulate the lengths of flexible cords on portable appliances.

1945

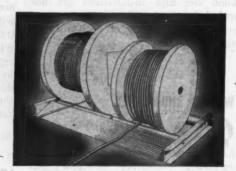


MAKES HANDLING EASIER SAVES TIME AND COSTS

Here's a brand new, easy, quick way to handle heavy reels efficiently. Requires no jacks or other cumbersome methods—merely roll the reel up the low incline into position on the rollers. Convenient—sturdy—light weight—built to carry loads in excess of that normally required for maximum reel sizes.



Style A—weight 50 lbs.—width 28 inches—capacity 2,000 lbs.—\$37.50 F.O.B. Cincinnati.



Style B—weight 110 lbs.—width 48 inches—capacity 4,000 lbs.—\$75.00 F.O.B. Cincinnati.

Write for full descriptive bulletin.

ROLL-A-REEL
327 WEST FOURTH STREET, CINCINNATI 2, ONIO

Inspection Bureaus have for year, endeavored to limit the lengths of cords on table and floor lamps, radios, toasters, irons, etc., to not over six feet and thus have worked up a sort of unwritten rule around that limitation. They have, however, also realized that a vacuum cleaner with only a six for cord would be of little practical us, (or would it be very useful in forcing the installation of a great many more receptacles in every room?)

The only code rule which could be used in an attempt to indicate in some way, the suggested lengths of cords, is found in Section 2110 where it is required that one receptacle be provided for every 20 linear feet of the total distance around the room. This would mean that no point along the wall, would be more than 10 feet from a receptacle and that therefore a cord would not need to be over ten feet long.

However, as stated above, there is no rule governing the lengths of cords.

—F. N. M. S.

MOTOR FOR PUMP HOUSE

I have inspected a small pump house containing a motor driven pump which is used to pump kerosene only. Should this motor and all other electrical equipment be of the explosion-proof type?—R.F.

No definite answer to your question can be found in the Code. However, the Code Committee issued an interpretation on June 4, 1942 which covers your question. That interpretation reads as follows:

"Section 5001 contemplates that the authority enforcing the Code shall determine when a particular premise or installation of apparatus conforms to the Code description of a hazardous location."

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Probably the safe rule for you to follow is to determine the flash point of the liquid or liquids to be handled, and if the flash point is higher than the ambient temperature is ever likely to be within the room or building in question special explosion-proof equipment is hardly necessary. If, however, the ambient temperature within the room or building is found to be above the flash point of the liquid being handled even if only for a comparatively short duration, the complete electrical installation should be of the explosion-proof type. Kerosene varies in flash in accordance with State laws, so it is necessary to determine the actual flash point. In some states this may be in the neighborhood of 100 degrees Fahrenheit, and it is natural to expect ambient temperatures that



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This year we've got to make 2=3! We've got to lend Uncle Sam in 2 chunks almost as

much as we lent last year in 3. Which means that, in the approaching 7th War Loan, each of us is expected to buy a BIGGER share of extra bonds.

The 27 million smart Americans on the Payroll Savings Plan are getting a headstart! Starting right now they are boosting their allotments for April, May and June—so that they can buy more bonds, and spread their buying over more pay checks.

Our Marines went over-the-top at Iwo Jima in the greatest, and hardest, battle in the Corps' history. Now it's your turn! Your quota in the 7th is needed to help finish this war, side-track inflation, build prosperity. So, captains of industry, plant your flag on top—like the Marines at Iwo Jima!

CAPTAINS of INDUSTRY—here's your Check List

for a successful plant drive:

- ★ Get your copy of the "7th War Loan Company Quotas" from your local War Finance Chairman. Study it!
- ★ Determine your quota in E Bonds the backbone of every War Loan.
- * Arrange for plant-wide showings of "Mr. & Mrs. America"—the new Treasury film.
- ★ Distribute "How to Get There"—a new War Finance Division booklet explaining the benefits of War Bonds.
- * Circulate envelopes for keeping bonds safe.
- ★ Display 7th War Loan posters at strategic points.
- ★ And—see that a bench-to-bench, office-tooffice 7th War Loan canvass is made.

The Treasury Department acknowledges with appreciation the publication of this message by

ELECTRICAL CONTRACTING

This is an official U.S. Treasury advertisement prepared under the auspices of Treasury Department and War Advertising Council



TELEVISION, SINCE PIONEER DAYS, HAS DEPENDED UPON CANNON PLUGS

Because Cannon Plugs and Receptacles were designed especially for use in critical circuits, they were incorporated into the first television hook-ups. Says Harry R. Lubcke, Director of Television for the Don Lee Broadcasting System:

"We find Cannon Connectors indispensable in our television operations. We called on Cannon in 1937 and what was probably the first all-television connector was fabricated."



All the circuits of a modern television camera pass through this single master Cannon Connector mounted on the side of the instrument. Equipment for the control of focusing, power and intensity of image is connected to power sources and to pick-up and broadcasting equipment through Cannon Plugs.

If you are interested in equipment of this kind, write for Cannon Condensed Catalog. Address Dept. A-231, Cannon Electric Development Company, 3209 Humboldt Street, Los Angeles 31, Calif. might easily reach that level during summer months especially should there be some other process or device present which brings about an artificial increase in the ambient temperature. Should the location be judged hazardous, the Code would require the use of Class 1 Group D approved equipment when subject to the vapors of petroleum products.—G.R.

LINK FUSES

Q. 1. "Please give me the meaning of sub-paragraph a of Section 2471 of the National Electrical Code."

—G. F. R.

A. a of the Code states that link fuses of less than 600 amperes rating shall not be used and when used in ratings of more than 600 amperes, shall be used only by special permission.

This, of course, applies only to such places as may be within the scope of the Code as set forth in the "Introduction" on page 6 of the Code.

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While there is nothing in 2471 which limits the voltage with which link fuses may be used, a limitation is found in Section 92405 which limits the voltage for link fuse holders to 250. The same table limits the amperage of link fuses and fuse holders to not less than 600 nor more than 1500 amperes.—F. N. M. S.

Q. 2. "How do you select the proper fuse to protect a transformer?"—G. F. R.

A. The ampere capacity of a fuse to protect a transformer should not exceed 200 percent of the ampere rating of the transformer. This is found in Section 4531 of the Code.—F. N. M. S.

PULL BOX DIMENSIONS

On a long feeder run of 3-inch conduit we found it necessary to insert several pull boxes and now we have been advised that the boxes are too small. Can you furnish the minmum dimensions for these boxes—H.W.M.

Minimum dimensions for pull boxes are now a part of the N. E. Code and are contained in Section 3706. For raceways of 1½-inch trade size or larger, the length of pull boxes installed for straight pulls must be

CANNON ELECTRIC

Cannon Electric Development Co., Los Angeles 31, Calif.
Canadian Factory and Engineering Office: Cannon Electric Company, Ltd.,
Toronto, Canada

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Every business organization in the country has a chance now to render a patriotic service. In spite of all efforts to date, paper is still a No.1 war material shortage.

Your dead files, old records and correspondence — all the paper not actually usable again or necessary to running your affairs—that's war paper. Turn it in to make bomb bands, supply parachutes, ration and blood plasma boxes.

Make a point of regularly salvaging all old paper around your place.

And adopt conservation as a general rule—use less paper than heretofore—use as little paper as possible.

If you sell your waste paper, and your local organizations have arranged for aid to wounded veterans, it will give you real satisfaction to use some of the money for this purpose, or to support some other worthy community project.







Newspapers: Fold them flat (the way the paper boy sells them) and tie them in bundles about 12 inches high.



Corrugated and Cardboard Boxes and Cartons: Flatten them out and tie them in bundles about 12 inches high.



Magazines and Books: Tie them in bundles about 18 inches high for easy handling by collectors.



Wastebasket Paper (Wrappers, Envelopes, Etc.): Flatten and pack down in a box or bundle, so that it can be carried



eight times the trade size of the largest raceway entering the box and for angle or U pulls six times the trade size of the largest raceway plus the total sum of the diameters of all additional raceways entering the box. This requirement does not apply to terminal housings supplied with motors nor to special boxes or fittings without knockouts and having hubs or recessed ports for terminal bushings and lock-Therefore the boxes installed on the 3-inch conduit run mentioned in your question would have to be at least 24 inches long for straight pulls. The rule does not specify the width or depth of the box used for straight pulls, but for an angle or U pull other dimensions must be considered. For instance, when a conduit enters and leaves through adjacent sides of a box, both the width and length are determined by the rule for angle pulls and when conduits enter either the top or bottom of the box and also two or more sides of the box all three dimensions must comply with this requirement. Therefore the width and length of the box used for an angle pull would have to be 18 by 18 inches.-G.R.

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General I

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METAL BOXES PROHIBITED

P. "Revision of Section 3716 by Interim Amendment No. 49 prohibits the use of metallic outlet boxes with non-metallic wiring sytems. Can you explain the reasons for this amendment, or why are metallic boxes prohibited on non-metallic installations?"—A. P. K.

The use of metal boxes is not prohibited in all cases where non-metallic sheathed cable is employed. Their use is prohibited in some instances under two conditions: First, under Interim Amendment No. 49 (Section 3716), where a "continuous underground water piping system is not available as a grounding electrode", non-metallic outlet boxes must be used on non-metallic sheathed cable as well as on open wiring, concealed knob and tube work and non-metallic waterproof wiring systems.

Second, under Interim Amendment No. 43 (Section 3372), where "non-metallic sheathed cable having one circuit conductor without individual insulation" is used, the boxes must be of non-conducting material.

The reason is so that fixtures attached to the outlet boxes may surely be free from any poor or false ground and so that any fixture or face-plates with which persons may come into contact, will not be connected to one side of the circuit wiring.—F. N. M. S.

THESE ANNOUNCEMENTS of new equipment are necessarily brief—for more detailed description, sizes, prices and other data write to the manufacturers' advertising departments, tell them in what issue of ELECTRICAL CONTRACTING you saw the item and they will send full details to you.

EQUIPMENT NEWS

Mercury Arc Converter

A new mercury arc converter which fills out the low frequency range of electronic equipment required in the growing field of induction heating applications has been announced. Designed for the purpose of electronically c h a n g i n g power at commercial frequencies of 60 or 25

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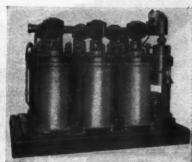
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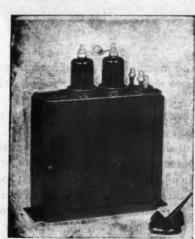


ALLIS-CHALMERS CONVERTER

cycles into 1000 to 2000 cycle power, the mercury arc type of frequency changer is particularly suitable for supplying power for forging, melting, and metal treating applications where large masses of metal or metal parts must be heated with this power at kilowatt capacities of 250, 500, 1000 and higher. Units are water-cooled, requiring no ventilation or air-filtering. Allis-Chalmers Mfg. Company, Milwaukee, Wis.

Capacitors for Electronic Oscillators

A new line of high-frequency, parallel-plate capacitors, designed for use in the resonant circuit, or "tank circuit" of high-frequency electronic oscillators, has cen developed. When connected in parallel with an inductance coil, this dass HFP, watercooled capacitor constitutes the resonant circuit which determines the frequency of the oscillator. In this



G-E CAPACITOR

application the capacitors are operated at relatively high voltages and may be required to carry heavy currents continuously at frequencies up to several megacycles. Some of the features are: low losses at high frequencies; uniformly high dielectric strength; high current rating per unit volume; and convenient mounting and connection facilities. Units are available in standard ratings ranging from 2000 volts, 0.025 microfarad to 9000 volts, 0.0056 microfarad. General Electric Company, Schenectady 5, New York.

Voltage Tester

These Knopp voltage testers are used for measuring circuit voltages and for determining whether they carry a-c, pure d-c, or rectified d-c current. They operate on the solenoid principle and indicate the nominal a-c circuit voltages of 110, 220, 330, 440 and 550, and the nominal d-c circuit voltages of 115, 230,



KNOPP VOLTAGE TESTER

and 600. A neon-light polarity indicator in the base of the SDP-2 tester is a new feature which not only shows the polarity of a d-c circuit under test, but also enables one to differentiate between a-c and rectified d-c current as well as between a-c and pure d-c. This light signals the presence of potential in daylight or darkness and provides, together with the solenoid indicator, a dual means of detecting voltage. It contains a mounting in the top of the case into which one prod may be inserted so that only the tester and one prod need be handled during tests. Incoming leads are separated from each other within the case for added safety in testing heavy-power circuits. A junior model, the SDP Tester is also available, which does not have the neon polarity feature. Electrical Facilities, Inc., 4232 Holden Street, Oakland 8, Calif.

Fluorescent Luminaire

A new fluorescent luminaire, known as the Eggcrate Aristolite, has been announced. It combines lamp-shielding and glass-diffusion in same unit. It provides down-lighting through eggcrate



GUTH FLUORESCENT UNIT

louvres, plus diffused side-lighting through glass-panels. Fixture has panelled and die-cut ends. Glass panels and eggcrates are separately removed for easy maintenance. Unit is available for individual or continuous installation and can be suspended from ceiling, or mounted directly to same. It is for four 40 watt fluorescent lamps. The Edwin F. Guth Company, 2615 Washington Ave., St. Louis 3, Mo.





WESTINGHOUSE INSULATING MATERIALS CATALOG

To simplify the selection of the right insulating material, we now have available the new Westinghouse Insulating Materials Catalog 65-000. It contains complete dimensions, ratings and other helpful application data on micas, fabrics, tapes and papers. Ask your Westinghouse Distributor for a copy today, or write Westinghouse Electric & Mfg. Company, P. O. Box 868, Pittsburgh 30, Pa.

Your motors and machines have taken beatings in these war years. Will they be able to meet the new par for electrical efficiency being set by the scores of newly-built war plants?

Your Westinghouse Distributor is equipped to help you make a full electrical check up of your plant, to find out... to tell you what's new about a lot of things electrical... to suggest ways to revitalize or replace equipment which now is obsolete or inefficient.

"Tuffernell" Insulating Materials are just one example of the completeness of the help he has to offer. For instance, there's the new Thermoset Varnish—No. 8826-1—which offers a longer lease on life to many weary motors than previously was possible. It is typical of hundreds of these "revitalizing materials" that he can supply or is equipped to use, to help you modernize electrically.

Don't gamble on electrical equipment you know is doubtful. Check up...revitalize...or replace... with the help of your Westinghouse Distributor!



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PLANTS IN 25 CITIES ... OFFICES EVERYWHERE

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Portable Electric Drills

A new development of Thor "Armored in Plastic" portable electric drills that introduces a side handle type machine has been announced. The new side handle type Thor drills are identical in construction to the original "Armored in Plastic" pistol grip machines, except for the side



handle. The gear case, field case and handle are molded in specially-developed "Thorite" plastic. Drills are available in three speeds, 2500 rpm., 3750 rpm., and 5000 rpm. They weigh 31 pounds and are 7-9/16 in. in length. Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago

Rectifier Tubes

Two new grid-controlled rectifier tubes have been announced. They are known as TT-17 and 873. Specifications of the TT-17 are as follows: filament-2.5 volts a-c at 5 amps; inverse peak plate volts-5,000 volts d-c at 2 amps. Average plate currentamp.; negative starting grid voltage; mercury vapor type; Size-61 by 2-5/16 in. with large plate connection at top, ceramic insulated; Small 4-pin ceramic base with filament and grid connection to pins. The 873 specifications are: filament-5 volts at 6.75 amps.; inverse peak plate volts-7,500



volts d-c 5 amps.; average plate current___ TAYLOR TT-17 125 amps.; size-84 by 2-5/16 in. with large top plate connection ceramic insulated; negative starting grid voltage; jumbo 4-pin base ceramic insulated with metal shell; mercury vapor type. Taylor Tubes, Inc., 2312 Wabansia Ave., Chicago, Ill.

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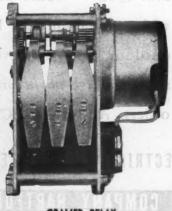
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J-06368

ril 1945

This motor operated d-c time delay relay was particularly developed for airborne radio, radar and electronic equipment but may be used in industrial applications where only d-c power is available or in a-c applications. The overall dimensions are approximately 2-9/16 in. wide by 3-13/16 in. long by 3-3/16 in. high. Timers are available for standard time ranges. It has cam and switch operating me-



CRAMER RELAY

chanism. Switch units are fully enclosed single pole, double throw with quick, double-make, double-break contacts rated at 10 ampere on either 24 volt d-c or 110 volt a-c, Motor is a permanent magnet type. Timers are available for 6 through 30 volts d-c. They can also be supplied with standard synchronous motor for either 110 or 220 volts, 50 or 60 cycle. The R. W. Cramer Company, Inc., Centerbrook,

Panel Instruments

A new line of 24 - inch hermetically sealed panel instruments, housed in steel cases and immune from the effects of humidity, moisture, chemical fumes and other harmful agents. has been announced. These new instruments, for d-c voltmeters and ammeters and for a-c radiofrequency ammeters.



G-E PANEL INSTRUMENT

can be furnished in all standard ratings mentioned in American War Standard ASA Specification C-39.2-1944. The hermetic assembly is sealed to the steel base by a silversolder operation. The metal base is secured to the case by means of a synthetic-rubber gasket that is coated with a special sealing compound. The glass seal, the soldered joints, and the metal ring form a completely hermetic enclosure for the instrument. Made for flush mounting on nonmagnetic or steel panels, these new instruments incorporate the standard 2½-inch internal-pivot element in a steel case which shields them from stray magnetic fields. General Electric Company, Schenectady 5, N. Y.



ASSOCIATED VIBROGROUND

Ground Resistance Tester

This new ground resistance tester, Model 255 Vibroground, is for extremes of wet and dry conditions. It has four ranges-0-3, 0-30, 0-300, 0-3000 ohms. It comes complete with self-contained power supply which eliminates hand cranking. Readings are direct. The design excludes strays from high potential networks, d-c ground currents or any a-c commercial frequencies, and other sources encountered in plant or field. The one-piece welded metal case is watertight. Associated Research, Inc., 221 S. Green Street, Chicago 7, Ill.



DIE-CAST, ZINC-BASE METAL HOODS

Stop corrosion in all weather. The sprayed aluminum finish makes a completely weatherproof job; attractively attests to quality workmanship throughout. No. 1306 — a 90° angle socket with shadeholder hood — has ½" angle connection for convenient, easy installation on conduit. Makes an attractive permanent job.

NOS. 1308, 1300, 1306-LEFT TO RIGHT

No. 1300 has ½" hex cap and shadeholder hood; takes 2¼" shade and medium base lamps. Fibre gasket between hood and interior seals against weather. No. 1308 — same as No. 1300 but without shadeholder hood. . . For the outdoor tests, however tough, these sockets "ask no favors" beyond your orders. ARROW ELECTRIC DIVISION,

DISTRIBUTED THROUGH ELECTRICAL WHOLESALERS

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD, CONN., U.S.A.

Electrica

Loudspeaker

The 24-A loudspeaker is designed
primarily for outdoor applications. It
is weatherproof with
a new type vitreous
finish which retains
its non - corrosive
qualities. The horn
is of exponential
form so that the offaxis levels follow



LANGEVIN LOUDSPEAKER

the usual curves. The horn has a bell diameter of 25 inches, overall length 38 inches, overall width 26 inches. It has a frequency response of 110 to 6500 C.P.S. Receiver attachments are available for coupling two or four driver units and making the horn capable of maximum inputs of 50 and 100 watts. The Langevin Company, Inc., 37 West 65th Street, New York 23, N. Y.

Fluorescent Lighting Fixture

This new type of fluorescent lighting fixture is equipped with the E-Z Servicer. The new fixture is hinged so that one man can open it for cleaning or changing tubes. No tools are required. It is made in four models including both ribbed glass glare



WILEY FIXTURE

shield and louvered types, industrial and commercial designs with two, three and four tubes and starter or instant type ballast. It can be installed either in single ceiling fixture or in continuous runs. R. & W. Wiley, Inc., Dearborn and Bridge Streets, Buffalo 7, N. Y.

Panel Instruments

New York, N. Y.

A new line of 13in, electrical instruments has been developed. They have been designed to withstand the extreme conditions of temperature, humidity, vibration and shock in aircraft service. Immersion tests have shown their ability to withstand hydrostatic pressures up to 14.7 psi. without case



ROLLER-SMITH INSTRUMENT

leakage. These instruments are available in d-c voltmeters, in all practical ranges above 50 millivolts and in d-c ammeters in all practical ranges above 500 microamperes. For certain applications lower ranges can be supplied. Roller-Smith, Bethlehem, Pa.

aligning silver contact, fingertip controlled by a knob switch, provides small increment voltage change throughout

the range of the device. Standard units are auto-transformer

type. They are available wound for constant current or

taper wound for current proportional to voltage. Some of

the design characteristics are drip-proof construction, high

overload capacity, conservative ratings, low no-load loss.

All working parts and windings are protected by ventilated.

heavy gauge shell for protection from dust and mechanical

damage. Windings are on shell type core, impregnated for

immunity to moisture and humidity. Mounting provides for

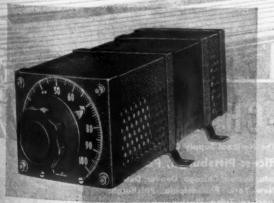
bolting to panel, support or table. Units are supplied either

with auto-transformer winding or separate windings for

isolation of circuits. Available for one or three phase use with single control. Gulow Corporation, 26 Waverly Place,

Variable Voltage Transformer

A new variable voltage transformer known as Vari-Former has been announced. It offers flexibility in a-c voltage control. Voltage is continuously variable, without circuit interruption, from zero to maximum values. A self-



GULOW VARI-FORMER

Reel Roller

A new reel roller for dispensing a ny material that is wound on a reel quickly, e as ily and safely. Some of the advantages are—ramp for loading reel onto rollers; back roller mounted slightly higher, preventing the reel from being pulled off the roller when cable



AUSTIN REEL ROLLER

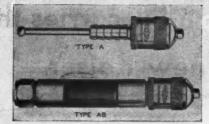
is removed; reel rolls on grease packed flanged ball bearings; thumb screw, which when tightened, prevents roller from turning; holes for lag screws for stationary mounting; five adjustable slots to accommodate various reel diameters; will take any size reel up to 30 inches in width. For larger reels, use two reel rollers and mount end to end. The M. B. Austin Company, 108 S. Desplaines St., Chicago 6, Ill.

945



Air Guns

A new line of leakproof air guns, for
hlowing chips, dust,
dirt, kicking out finished parts and
operating air-driven
tools, has been anmounced. A slight
finger-tip flex of the
hose discharges a
small puff or full

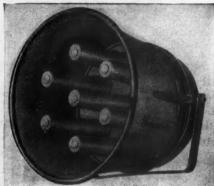


TRICO AIR GUNS

that of air as desired. Levers, buttons, gaskets or glands are eliminated by the streamlined design. Air pressure helps close valve tightly when finger-tip pressure is released. Type "A" is for permanent applications. Type "AB" is recommended for remote control applications. It is attached directly to the air pipe line and operated by hand, knee or foot control, treadle, pulleys, cams, plungers, etc. Available in three styles and for complete range of hose diameters. Trico Fuse Mfg. Co., 2948 North Fifth Street, Milwaukee 12, Wis.

Speaker

This super power multi - reflex. speaker, AA - 7, was designed for ong range sound projection over wooded or built up areas, rough terrain or water. It has a superpower audio caacity of 200 vatts and is designed with 250 cycle low frerequency cutoff.



UNIVERSITY SPEAKER

Projection range of speaker is over 1½ miles. Projector mounts a battery of 7 Model PAH, hermetically sealed, shock and blast proof driver units. It has many applications for the commercial and sports field, besides its wartime use. University Laboratories, 225 Varick Street, New York 14, N. Y.

Control

1945

A control specially developed to operate barn hay-drying installations has been announced. The equipment, consisting of a magnetic starter, a time switch and a thermostat if required, is now available to operate either 3- or



5-hp., 230 volt, 60 cycle single-phase motors such as the SCR type. The magnetic starter, either manually or automatically operated, is equipped with a selector switch with on, off, and automatic positions. The time switch, with

three sets of riders, is used primarily at night to start and stop the blower periodically if the humidity is too high. Three on and off predetermined operations are possible in a 24-hour cycle. Both two and three pole receptacles are a feature of the new control. The three pole receptacle is for the time switch plug and the two pole is used for plugging in a remote control lead, or thermostat. When a thermostat is used it is inserted into the hay and turns the blower on to cool. Complete hay-drying outfits consist of a motor-driven blower with proper control and air ducts laid on the floor of the hay loft in existing barns. General Electric Company, Schenectady 5, N. Y.

Circuit Tester

A new circuit tester, called the "Lo-Volt" Test Glo, has been announced. It is for testing circuits from 5 to 50

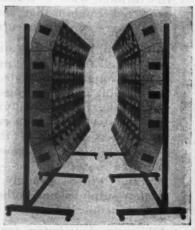


IDEAL TESTER

volts. It simplifies the testing of open circuits, burned out fuses, and can be used for indicating the relative value of line voltage. The incandescent "glow" lamp is protected by a transparent plastic housing. Overall length is seven inches. Fully insulated test leads are four inches long. This tester is particularly suitable for electricians, telephone repair men, automotive and aircraft mechanics. Ideal Commutator Dresser Company, 1041 Park Avenue, Sycamore, Ill.

Infra-Red Equipment

A new design of infra-red equipment, known as Evenray Systems, has been developed. It consists of models known as 40-000, 43-000 and 47-000. The system provides for wide variation in watts density input; even distribution of energy; and efficient utilization of energy. Models 40-000 and 43-000 utilize reflector type sources, in 125, 250 and 375 watt, 120 volt lamps. The reflecting surfaces



FOSTORIA INFRA-RED EQUIPMENT

in which the reflectors are mounted are gold plated, to reflect approximately 95 percent of the radiant energy. Source centers on the 40-000 model are 6-19/32 inches and on the 43-000 models are 8½ inches. Model 47-000 accommodates clear sources ranging from 125 to 1000 watts and a specially designed, gold-plated reflector with rectangular flange. Source centers are 11 inches. All models provide protection for source bases and for ventilation of heat which might be conducted or reflected to sockets and wiring channels. The sockets and wire on Models 40-000 and 43-000 are enclosed in wiring channels mounted on the back of the sections, outside the oven. On Model 47-000 the source bases, sockets and wire are shielded, with wireways mounted inside the 11-inch square sections. The Fostoria Pressed Steel Corp., Fostoria, Ohio.

Walker "Dualcote" Conduit carries the electric cables in the new Kaiser steel plant

This great plant of Kaiser Company, Inc.—the only completely integrated steel plant on the West Coast—is another of war-time's amazing structural achievements. Within eight months after ground was broken, the blast furnace was in operation . . . to be followed quickly by other production units. Today, pig iron is being poured at a rate of 430,000 net tons annually—steel ingots and high grade alloy steel, 700,000 net tons.

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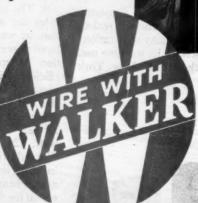
A portion of the Fontana steel plant of Kaiser Company, Inc., now producing much of the steel used in West Coast shipbuilding.

It is significant that in this modern and efficiently equipped plant the numerous electric cables are carried through Walker "Dualcote" Conduit... the twice-protected conduit that successfully withstands the most severe conditions encountered in a steel plant.

Into both inside and outside walls of Walker "Dualcote" Conduit, is fused a layer of zinc which is so thoroughly distributed that even the threads of the conduit and couplings are fully protected with

zinc coating. Being actually alloyed with the steel, it will not crack or flake when bent. And the tiny teeth covering its surface securely grip the outer coating—a new material which strongly resists steam, sulphur and other corrosive chemicals.

Ask your distributor for prices and deliveries. For further particulars, write to WALKER BROS., Conshohocken, Pa.



Many miles of Walker "Dualcote" Conduit are in the power transmission lines.

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SWITCH EQUIPM

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GARNETT YOUNG and COMPANY,
San Francisco, Los Angeles & Seatife
Pacific-Coast Agents

WALKER Conshohocken

Makers of: Rubber-covered, Synthetic and Leaded Wires and Cables * "Walkerflex" Non-matrillic Sheethed Cables * Service Entrance Cables * Automotive Wires and Cables * Shipboard Cables * Leaded, Non-Leaded; Synthetic or Varnished Cambric Insulation * Electric Metallic Tubing * "Dualcate" Rigid Steel Conduit * "Preset-Insert" Junderfloor, Distribution Systems.

Keep Up-to-date on new Developments through this FREE SERVICE....

Electrical Contracting brings you the latest literature of leading manufacturers without cost or obligation.

HIGH-VOLTAGE D-C SUPPLY

1 Folder GEA-4317 illustrates and describes high-voltage d-c supply metal-enclosed equipment for testing of electric equipment; precipitation; induction heating; radio and miscellaneous industrial and electronic applications. General Electric Company.

SWITCHES

2 Circular No. 600 features automatic transfer switches, remote control switches, contactors and relays. Wiring diagrams and illustrations are shown. Automatic Switch Co.

CABLE ENTRANCES

3 Thru-type, compound filled cable terminators or potheads are described, listed and dimensioned in Publication No. 4412. Delta-Star Electric Company.

DURONZE MANUAL

A revised 80-page Duronze manual containing specifications and technical data on five copper base alloys. These alloys are also used for outdoor electrical equipment, wire and cable connectors and other parts, which must withstand temperature extremes. Bridgeport Brass Company.

THERMOSTATIC CONTROL

5 A new 20-page booklet describes and pictures seven types of bimetal thermostats to fill a wide range of applications. Characteristics and capacities of each unit are discussed and tabled for easy selection, and cross sections, curves and drawings illustrate operation and proper mounting of units. Westinghouse Electric and Mfg. Co.

FLUORESCENT LIGHTING EQUIPMENT

A new 8-page catalog section (No. 11-44) gives dimensional data, photometric performance, and layout design helps on the "Grenadier" commercial fluorescent lighting fixture. The F. W. Wakefield Brass Co.

SWITCHES AND ELECTRICAL EQUIPMENT

7 A new catalog illustrating and describing switches and electrical

equipment for the automotive, marine and electrical appliance trade. Ark-Les Switch Corporation.

REPLACEMENT RANGE UNITS

A new 12-page bulletin (No. CF-145) features Chromalox replacement range units for all electric ranges. It tells how to order and install range units and furnishes complete charts of replacement data. Available adaptor rings, ring elements and replacement parts are listed. Edwin L. Wiegand Company.

INSULATION MATERIALS

Q Catalog No. EL44-7 consists of 24 pages and describes the properties, forms and applications of Fiberglas electrical insulation materials. Owens-Corning Fiberglas Corp.

ELECTRON TUBES

A new catalog illustrating and describing transmitting triodes; mercury-vapor rectifiers; high-vacuum rectifiers; grid-control mercury-vapor rectifiers; power amplifiers; and voltage regulators. General Electronics, Inc.

RURAL TRANSFORMERS

11 Bulletin No. S-301 illustrates and describes rural type trans-

CONTRACT CONTRACTOR

formers built to ASA and REA specifications. The Standard Transformer Company.

FLUX FOR SILVER SOLDERING

A new 4-page bulletin describes
No. 6 flux for silver soldering
and gives detailed instructions for its
use. It can be used with any low melting point brazing alloys or silver solders, for joining both ferrous and nonferrous metals and alloys. Superior
Flux Co.

INSTRUMENTS

Bulletin No. 111 illustrates and describes volt-ohm-milliammeter; a multi range a-c ammeter; mego-meter; and speed-o-meter. Superior Instruments Company.

CONTROLS AND MOTOR CONTROLLERS

14 Catalog No. 145 features B/W floatless liquid level controls and industrial motor controllers and contains new data, pictures of special control panels, and application diagrams. B/W Controller Corporation.

RESISTANCE WELDING ELECTRODES & ALLOYS

15 A new catalog on resistance welding electrodes and alloys.

Circle numbers, sign and paste on your letterhead and mail in an envelope.

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... and get these important advantages

- * Proper types and sizes for all applications
- * High-efficiency, the result of scientific design
- ★ Long life and low maintenance expense, obtained through sturdy construction
- Expert assistance with application problems, backed up by 30 years' experience
- * Convenient sales and service facilities

WANT THESE HANDY DESCRIPTIVE LEAFLETS FOR YOUR PROPOSALS?

FLOODLIGHT	PUBLICATION	G-E NOVALUX AREA FLOODLIG
Heavy-duty, steel casing 200 or 250 watts, Type L-29 300 or 500 watts, Type L-30 750 or 1000 watts, Type L-31	GEA-4303 GEA-4304 GEA-4305	TOP-L- TOP-L-
Heavy-duty, cost aluminum 200 or 250 watts, Type L-38	GEA-4325	The second secon
General purpose, sheet aluminum 300 or 500 watts, Type L-49 750 or 1000 watts, Type L-43	GEA-4311 GEA-4310	CE NOVALUX HEAVY-DUTY FLOODUGHT
Sports and area, sheet aluminum 750 to 1500 watts, Type L-68	GEA-4333	
Area, open porcelain enamel 300 to 1500 watts (Type L-45) (Type L-46)	GEA-2877B	
Handy, sheet aluminum 200 watts, Type L-66	GEA-4346	



GENERAL % ELECTRIC

It lists the complete line of standard spot welding electrodes and water-cooled holders. Stock sizes of alloys their various applications and typical physical properties are also included. P. R. Mallory & Co., Inc.

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VIBRATION-MEASURING **EOUIPMENT**

16 Catalog GEA - 4140 features equipment to measure vibration -vibration indicator, dial type; vibration indicator, light-beam type; and vi-bration-velocity meter. General Eelctric Co.

ELECTRICAL SPECIALTIES

17 New bulletin featuring steel hangers for cable, conduit and messenger uses, jiffy steel clips, steel straps for messenger cable services on outlet boxes, porcelain insulating bushings and cable-pulling and insulating compounds. Minerallac Electric Company.

ELECTRIC HAND TOOL

18 A four-page bulletin entitled "More Power To You" describes the Precise-35 high-speed electric hand tool designed to operate at 35,000 rpm., develops 1/6 hp. and weighs 35 ounces. Precise Products Company.

STEEL STAMPS

A new folder giving complete data and prices on steel letter and figure stamps developed for the use of industrial plants producing heavy and light precision machine products. Acromark Company.

EXPLOSION-PROOF MOTOR

A bulletin describing and illustrating explosion-proof motor Class I Group C for Ethyl ether vapor applications. Century Electric Co. A bulletin describing and illus-

ELECTRICAL PRODUCTS

A new catalog No. 129 featuring this line of safety switches, service equipment, multi-breakers and other circuit breakers, panelboards, bus and feeder duct, motor control and pressure switches. Square D Company.

ELECTRIC EQUIPMENT FOR **ARC FURNACES**

Catalog GEA - 4246 features Catalog GEA - 424b features complete electric equipment for arc furnaces. It includes sections on control, switchgear and transformer. General Electric Company.

RG CABLES

A new catalog Section "D" de scribes 26 different types of RC cables and also many companion high frequency connectors for U.H.F. and electronic applications. American Phenolic Companion high specific Companion of the control of the nolic Corporation.

BALLASTS

A 16-page catalog illustrates and describes ballasts for fluorescent units. In addition to factual

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data on the improved Bestron ballast housing model—its application, installation, and operation—it contains sections on fluorescent lighting in general. Hudson American Corporation.

LIGHTING PRIMER

25 The new "Mitchell Lighting Primer" explains the lighting business and gives a dictionary of terms. It lists many of the technical and semi-technical terms used in the lighting industry, includes a short layman's history of lighting, and an a-b-c explanation of lamps and fixtures, how they are made, sold, and distributed. Mitchell Manufacturing Company.

WIRE

ENTRANCE

SERVICE

ELECTRICAL CONNECTING DEVICES

26 A new 32-page catalog, No. 14, features this complete line of multi-contact plugs and sockets, terminal strips, fuse mounts, etc. Complete dimensional data of all items are given. Howard B. Jones Co.

ELECTRICAL SIGNALS

27 Catalog No. 61 features sections on uni-pact signal systems; bells; chimes and buzzers; marine bells and buzzers; bell accessories; horns, air trumpets and sirens; Navy and marine horns; pushbuttons; transformers; relays and annunciators; clocks and electrical features. Faraday Electric Corp.

ELECTRONIC HEATING

28 A 16-page booklet written for both engineer and manufacturer on the subject of electronic heating. Many illustrations are used and several types of high frequency generators are shown. Scientific Electric.

CHLORINATED PARAFFIN

A new technical bulletin on Chlorowax gives complete information on the product together with specific tables and data on its properties. Included are tables of physical properties, chemical properties, solubility and compatibility with plastics. Diamond Alkali Company.

REPLACEMENT TUBE MANUAL

A 20-page manual providing practical replacement tube data to help radio servicemen during wartime tube shortages. It gives full information needed for the adaptation of available tubes to many different types of radio receivers. Sylvania Electric Products, Inc.

INSULATING VARNISH SELECTOR

31 The job of selecting the correct varnish for treating and insulating coils and windings and for general motor repair can be simplified by using an insulating varnish selector. General Electric Co.

MICA CERAMIC INSULATION

32 A 12-page bulletin presenting a complete discussion of the advantages and disadvantages of all types

RUBBER POWER CABLE . VARNISHED CAMBRIC CABLES

CRESCENT SYNTHOL TYPE SNW

FOR MORE COPPER IN WET LOCATIONS



LEAD-ENCASED

AND

No. 14/3 Conductor, Type RL Carrier 15 amps.

Three No. 10, Type RW Carry 25 amps.

For 3/4" Conduit



NEW

Three No. 6, Type SNW Carry 54 amps.

Insulated with a special thermoplastic that is extremely resistant to moisture, acids, alkalies and oil, inherently flame-retarding, high dielectric and mechanical strength, bright, permanent colors, small diameter, easy pulling free stripping

SYNTHOL TYPE SNW

is approved by Underwriters Laboratories in sizes from No. 14 through No. 4/0 AWG under section 3035 of the 1940 N.E. code for use in raceway systems, such as: (a) Underground, (b) In concrete slabs or other masonry in direct contact with the earth, (c) In wet locations, (d) Where the condensation and accumulation of moisture within the raceway is likely to occur.

Write for Descriptive Folder on SYNTHOL Types SNW and SN

CRESCENT INSULATED WIRE & CABLE CO. TRENTON, N. J.

Available Through Electrical Wholesalers

IMPERIAL NEOPRENE JACKETED PORTABLE CABLES

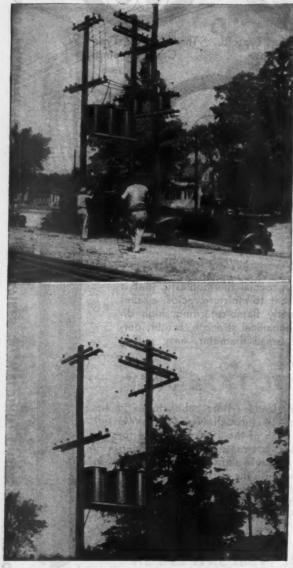
Electrical Contracting, April 1945

WELDING

NO. 4 OF A SERIES ON THE Service Superiority OF

TRANSFORMERS

Standing Overloads.



These DAVIS transformers are on the lines of a utility servicing a war plant. Due to rapid expansion of the war plant, the 3 DAVIS 15 KVA transformers became overloaded. For several months they were carrying a load much closer to the 150 KVA which should have been provided than the 45 KVA available. In this overloaded condition, they withstood line surges caused by summer thunderstorms with no lightning arrestors on the line.

The oil in the transformers became so hot that, even in cold weather, it literally boiled over and ran down the sides of the cases. Yet the 15 KVA units did not break down. They were in good operating condition, when finally replaced, after 10 months service, by the 50 KVA transformers

The upper picture shows a bank of three 15 KVA transformers being removed after the installation of three 50 KVA units. The lower picture shows the three 50's in operation.

Had the 15's failed, the war plant would have had to shut down, while replacements were installed. This example of the dependability of DAVIS transformers, proves their reliability even under extreme circumstances.



DAVIS TRANSFORMER CO.

hone 177 CONCORD, N. H.



STOCKWELL TRANSFORMER CORP.

CONCORD, N. H.-Phone 177 AKRON, OHIO-Phone Jefferson 4179

Manufacturers of Oil Cooled, Dry Type, Power and Distribution Transformers
Also All Types of Specialty Transformers Regardless of Size

of insulation and stating the case for Mykroy perfected glass-bonded mia ceramic No. 51 in its application to injection molding. Electronic Mechanics, Inc.

SOLDER BACKED CONTACTS

A new folder, Catalog C-II, covering silver solder backed contacts in Gibsiloy and silver for braing. Construction and advantages of solder-backed contacts and various methods of brazing are described in detail. Gibson Electric Company.

ELECTRIC UNIT HEATERS

New Trade and Consumers Net Price Sheets on Electromode electric unit heaters give data on heaters from 1.5 to 60 kw., along with prices on switches, contactors and thermostats. Electric Air Heater Company.

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V-BELT DRIVES

35 Catalog, B6051E, on V-belt drives, gives all the required information to make correct drive selections reduced to handy charts, tables and drawings. List prices, stock size, dimensions and construction details are included for all Texrope drives. Allis Chalmers Mfg. Co.

ELECTRICAL INSULATING MATERIALS

An 86-page illustrated manual on electrical insulating materials. It includes data, tables and values on sheet mica, built-up mica, laminated plastics, varnished cloth and tapes as well as miscellaneous insulating materials such as varnishes, twines and fiberglas. Mica Insulator Company.

INDUSTRIAL ELECTRONICS

37 A 40-page booklet, GEA-4309, is a series of articles on Fundamentals of Industrial Electronics. General Electric Company.

TEST CLAMPS

Bulletin No. 7 illustrates and describes a line of test clamps, with solder or solderless lugs attached for making heavy duty temporary expections, motor and meter tesing jumpers, cable and busbar taps, battery charging, welding and many other shop and laboratory purposes. Trice Fuse Mfg. Co.

CARBIDE TIPPED TOOLS

A 20-page manual giving complete data on Carmet carbide tipped tools, including information on grades of Carmet available, terminology, grinding, chip breakers, coolant, brazing, hints on set-up and adaptation of standard tools to special uses. Allegheny Ludlum Steel Corporation.

ELECTRONIC PRODUCTS

40 A new 8-page condensed catelog called "Norelco Electronic Products." It covers Cathode-ray transmitting, power and amplifier tubes; film-type x-ray diffraction equip

ment; Geiger-Counter X-ray Spectrometer; oscillator plates; Searchray in-spection units; and metallurgical products. North American Philips Company, Inc.

MANUAL OF BETTER HOME WIRING

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A booklet entitled "Manual of Better Home Wiring" in which the principles of better wiring outlined in "Electrical Living in 194X" are translated into actual wiring requirements and specifications recommended at a minimum for better wiring. West-inghouse Electrical & Mfg. Co.

INSULATING VARNISHES AND COMPOUNDS

42 A 56-page booklet containing many helpful tables, charts and articles compiled for the purpose of providing a worthwhile approach to any insulating varnish problems. It is a handy reference for the selection of insulating varnishes and compounds, thinning of insulating varnishes, etc. John C. Dolph Company.

MOTOR ELEMENTS

43 A new 32-page book entitled "Matches Motor Parts" gives information of practical value to producen of electrically powered tools and other equipment operated by fractional or integral horsepower motors. Robbins & Myers, Inc.

TRANSFORMER

44 Bulletin S-301-A describes a new one kva. Type SRO oil filled transformer for rural line service. It contains illustrations of the core and coil assembly, SRO with cover removed, SRO with valve arrester and detailed drawings of high voltage bushing with high voltage protective fuse, the hanger and top and side dimensional views of the unit. Standard Transformer Co.

LIGHTING FIXTURES

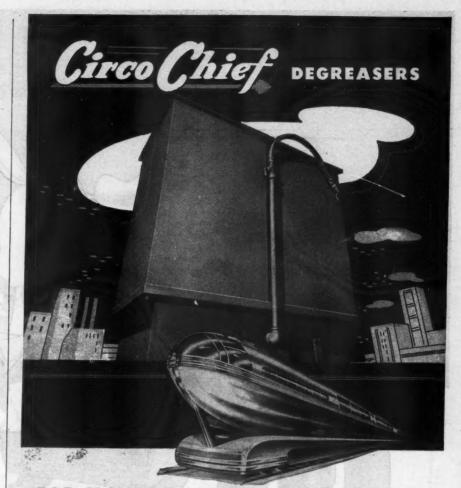
45 Bulletins F-80 and F-82 teature the Coronado and Parkway commercial units and the Hydee hanger for use with all chain suspended fluorescent industrial fixtures. Day-Brite Lighting, Inc.

INSTRUMENTS

46 Bulletin No. 44-1 illustrates and describes four models of individual-mount tachometers and the multi-range portable hand tachometer. It gives mounting dimensions and includes prices for tachometers and appurtenances. Jones Montrola Co.

MARINE FITTINGS

47 Bulletin 1042 illustrates and describes this standard line of marine Unilets, consisting of switch and receptacle fittings, function fittings, and lighting fixtures. Appleton Electric Company. Company.



FOR MODERN . FAST . STREAMLINED Parts Cleaning

Progress is born of experience, and in the new, modern Circo "Chief" Degreaser you get the most advanced parts cleaning unit on the market—designed, engineered and built by Circo Products Company, pioneers in the manufacture of parts cleaning equipment. • The modern Circo "Chief" Degreaser fused with four different parts cleaning methods housed in the one unit, cover the complete range of scientific, economical parts cleaning processes—vapor cleaning (automatic), spraying (automatic), soaking and dipping. • When parts are greasy and grimy, simply place them in vapor tank and in three minutes time the pure solvent vapors clean parts thoroughly, rinse and dry them. Never, at any time in the vapor tank, do parts come in contact with anything but the pure, clean solvent vapors. Circo "Chief" will clean any and all types of metal parts at the same time without any harmful effects. Solvent is non-inflammable and can be safely used anywhere. . To spray parts, merely trip foot pedal, pump goes into action, supplying a constant pressure stream of solvent. Unique basket enables operator to hook handles over side of tank while vapor cleaning, soaking, dipping or spraying.

Circo "Chief" is the most modern, fastest and most economical parts cleaning unit on the market. Send for more detailed information.

CIRCO PRODUCTS CO.

2835 CHESTER AVE. . CLEVELAND 14, OHIO





Blessed Event



The Hewell Protected Type Motor, shown, gives complete protection against dripping liquids, metal chips and other falling particles. Completely streamlined—utilizing non-breakable steel frame—malleable or steel base—cast iron end plates and cast iron, weatherproof terminal box are standard construction features. Special horizontal and vertical mountings are available.

Available in sizes 5 H.P. and smaller. Other sizes and types available up to 150 H.P.

The reception given a new Howell Motor in any plant comes right from the heart. For when a Howell of any size or type is delivered, you can be certain of two things:

- Every Howell Motor is built of the finest materials, is statically and dynamically balanced, and thoroughly insulated throughout—
- Our steadfast policy of maintaining pre-war standards, with no compromise in quality, is being rigidly maintained.

Yes, we are swamped with orders today. The delivery situation in the entire electric motor industry is serious. But we fully recognize our obligations, and we are putting forth our maximum efforts to see that Howell Motors are distributed among those users whose needs are most vital to the war effort.

Buy Horsepower by
HOWELL ELECTRIC MOTORS COMPANY

HOWELL, MICHIGAN

Manufacturers of Quality Motors Since 1915

Electrical Contracting, April 1945

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IN THE NEWS

ELECTRICAL COMMITTEE MEETING POSTPONED

The Electrical Committee meeting cheduled for the week of May 14th in Chicago has been indefinitely postponed under the moratorium on meetings imposed by the War Committee of Conventions. This action will probably delay for an indefinite period consideration of the Article Committees' recommendation for the revision of the National Electrical

Article Committee reports which were to be considered by the Electrical Committee this year consist of 127 pages of changes and comments. This is the most extensive Code revision in detail in the history of the National Electrical Code. Many of the recommended changes are adaptations of wartime interim amendments to permanent Codes rules. Highlights of the Code recommendations include new tables of wire carrying capacity and conduit fill, extensive revision on the rules pertaining to hazardous areas, much new material pertaining to fixtures, and considerable broadening of the scope of the Code with respect to the installation of transformers.

Many tables on the number of conductors in conduit ir tubing will be of particular interest, since the recommendations recognize the smaller over-all diameter of many recently developed types of wire. New Table 4, covering R and RH conductors, for instance, permits as many as five No. 14's in ½ inch and up to four No. 12's. The change recommended the substitution also of No. 9 wire for Nos. 10 and 8 to provide a 30 ampere branch circuit, and the addition of a No. 7 conductor provides a current value approximately half way between No. 9 and No. 6. For latex and thermoplastic small diameter wires, recommended Table 7 allows up to nine-14's or up to seven No. 12's in ½ inch.

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Rules pertaining to transformers are rearranged and revised in the Article Committee reports. The new arrangent includes several paragraphs giving specific provisions applicable to the in-stallation of different types of transformers such as the dry and askarel type.

Developments in the electric welding art are reflected in the fact that an entirely new article covering that subject is offered for the revised Code. Another new article is one dealing with installation of electrical equipment in and on machine tools. Remote control, low-energy power and signal circuits are covered in a new Article-725, leaving only communication circuits in Article-800 which formerly included them.

WPB ADVICE TO EMPLOYERS REGARDING SELECTIVE SERVICE

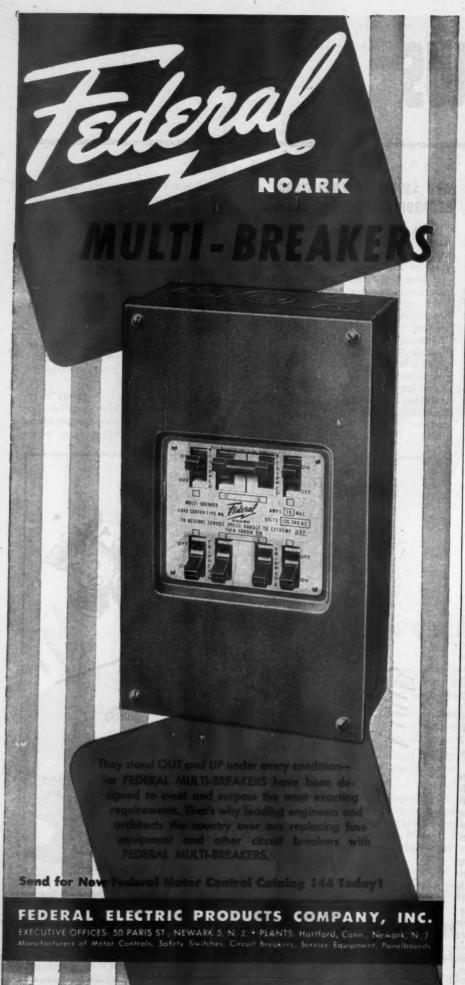
An Advisory Bulletin, INFL-484, was issued March 1, 1945 by the office of Manpower Requirements, WPB, to provide for employers a single consecutive statement of current Selective Service procedures affecting occupational deferment. It indicates what provisions have been made to assist local boards in reviewing registrants in three age groups: 18 through 29; 30 through 33; and 34 through 37. It lists the bases for occupational deferment for the three age groups. discusses the check on registrants who leave employment, the list of essential activities, consideration given for fathers, occupational deferment of men not qualified for combat service, and registrants deferred by reason of hardship.

Local board procedures are outlined for the benefit of employers, and information which should be furnished to local boards is given in detail. For registrants under 30 years of age, the employer should file Form 42A (Special Revised). This Form should be submitted to the appropriate Federal Government agency having jurisdiction over his activities for certification or denial of certification by such agency. These agences are listed in INFL-484. Form 42A (Special Revised) for registrants under 30 years of age, and Form 42A for registrants over 30 years of age, should be on file for every registrant in a company's employ for whom deferment is believed to be justified.

Employers who find it necessary to request occupational deferment for key employees should observe the procedures of INFL-484. In urgent cases where



referring to.



assistance is desired, the employer should consult with WPB or other sponsoring agency promptly to insure that all pertinent evidence is made available to the local board before its action is completed.

LOANS FOR HOME REPAIRS AND MAINTENANCE

Nearly 390,000 American families financed urgently needed home repairs and maintenance last year with funds advanced by private financial institutions and insured by the Federal Housing Administration of the National Housing Agency, according to an announcement by Commissioner Abner H. Ferguson.

Loans reported during 1944 by these institutions for FHA insurance under Title I of the National Housing Act numbered 389,592, and amounted to \$125,150,082, compared with 308,161 such loans for \$96,373,831 reported during 1943.

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It is estimated that property repairs and improvements in the first twelve months after building restrictions are removed will probably aggregate \$3,000,000,000. FHA has sufficient authorization under Title I to insure a financing volume conservatively estimated at about \$1,000,000,000, Mr. Ferguson said.

UTILITIES ORDER U-9 AMENDED

The War Production Board Office of War Utilities announced the issuance of an amendment to Utilities Order U-9, the brownout order, which was issued January 15 as part of the national coal conservation program. This amendment limits outdoor entrance lighting to the



ELECTRONIC EXHIBITS at the national content Milwaukee E.M.E. Industrial Electrical Exposition are frequented by I.B.E.W. Journeymen (L to R) W. J. Norton, Hatfield Electric Co., Isdamapolis, Ind.; I. H. Hungiker, Sanitary District of Chicago; and M. L. Bassen, Puget Sound Navy Yard, Bremerios, Washington. All are attending the I.B.E.W. National Electronics School a Milwaukee's Marquette University, Bassett's hobby of building fleapower moton (smallest develops 13 billionths of our borse-power at 3600 rpm.) bas gained national recognition.



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COOPERATIVE SPIRIT between labor and management in the Dallas, Texas, electrical contracting group is discussed by Robert Fishl (left) Albright Electric Co., and P. M. Laughlin, business manager, IBEW Local 59 at Dallas.

minimum required for public health and safety and in no case permits entrance lighting of more than 60 watts per entrance.

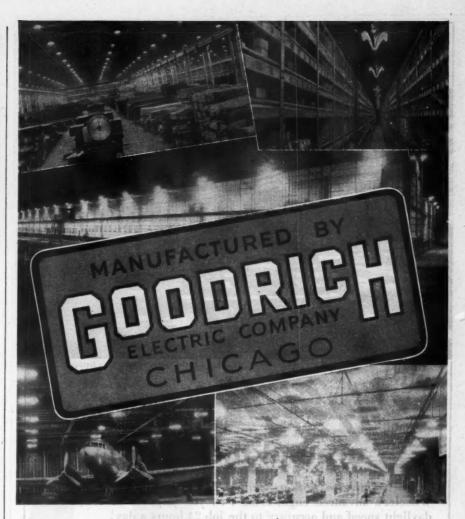
Already prohibited by the order are show window lighting and lighting in outdoor locations and public passageways that is for display, promotional, decorative or advertising purposes.

The amendment was issued, OWU said, to clarify the original intent of the order. which is to conserve coal and other scarce fuels by the elimination of all unnecessary outdoor lighting. Since the brownout went into effect, OWU said, field reports have shown a widespread misunderstanding by consumers of the fact that entrance lighting intended primarily for promotion, decoration or to light show windows is prohibited by the order.

SCHEDULE A TO CMPR NO. 6

es in the construction limitations licable to authorized building projects, h reflect recent modifications in War oduction Board orders governing ma-als and equipment used in construction, se been incorporated in an amendment Schedule A to Controlled Materials in Regulation No. 6, WPB has

The revised restrictions are applicable all construction authorized on Form GA-1456 on or after February 17, 1945 following approval on Form WPB-617. In addition, a builder whose authorization was issued before that date may take advantage of any provisions of the amendment. The changes also apply to certain utility construction controlled by WPB Order U-1 (Utilities). They do not, however, apply to housing construction authorized by the National Housing Such housing is subject to Limited Preference Rating Order P-55-c,



What This Label Means to Users of Lighting Fixtures...

Wherever you see the Goodrich label, it identifies the best that modern science and methods can produce in industrial illumination. It guarantees your satisfaction-now and years from now.

Goodrich industrial lighting equipment conforms with the highest known standards of manufacture in every respect - in quality ... in efficiency...in safety...in lasting value as proved by actual service.

Goodrich's entire facilities, engineering and research staffs, are devoted exclusively to the design and manufacture of industrial lighting equipment. Goodrich's vigorous leadership brings you many exclusive developments in reflectors, fittings and mechanical features for all kinds of general and special applications. all-Steel Open-End

Sold through electrical wholesalers.











VAPORLITE

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THE REFLECTOR IS THE BACKBONE ANY LIGHTING SYSTEM . . .



Scraping Dept. Gould & Eberhardt, Inc., Irvington, N.J.

Day Skift production around the clock!

When you give workers Skilled Lighting . . . the product of Wheeler's advanced engineering . . . you improve morale, bring daylight speed and accuracy to the job 24 hours a day!

That's one big reason why it's important to install Wheeler Reflectors - product of 64 years of specialized light engineering. Wheeler Units are engineered to provide maximum light from standard lamps. Their high reflection factor puts light to work where it belongs - on the job. Made of heavy gauge metal, coated with vitreous enamel, their rugged construction insures long service, easy maintenance.

Learn how these better-engineered units can bring Skilled Lighting to your production scheme. Send for catalogs showing complete line of incandescent and fluorescent fixtures. Wheeler Reflector Company, 275 Congress St., Boston 10, Mass. Also New York. Representatives in principal cities.



Available for two or three 40-watt, or two 100-watt lamps, Broad wiring chan-nel with accessible, enclosed ballast. Can be mounted from chain or con-

duit, individually or in continuou runs.



RLM Solid Neck Incandescent Reflector Maximum lighting efficiency for either indoor or outdoor use. Expertly designed, ruggedly built. 75 to 1500 watts.

Distributed Exclusively Through Electrical Wholesalers

heeler skilled ting REFLECTORS

Made by Specialists in Lighting Equipment Since 1881

and not to Schedule A of CMP Regula-

tion No. 6, WPB pointed out.
Form GA-1456 is used to authorize most commercial, industrial and agricultural construction controlled by Conservation Order L-41, the basic construction order. Other forms are used for housing construction approved by NHA, for certain Army and Navy construction and for other specialized kinds of construction

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Because of the current shortages of sheet steel, the amended schedule restricts the use of various fabricated items made of sheet steel and strip, including doors, electric metallic tubing, partitions except toilet partitions, raceways and other items. It also restricts the use of fencing, tanks and tank towers. Restrictions on the use of metal lath, which were contained in the May 23, 1944, and August 7, 1944, issues of the Construction Limitation, but omitted in the October 31, 1944 revision, have been reinstated in today's amendment.

Plywood form liners are now prohibited, but tongue and groove lumber is permitted for forms where used lumber or plywood is not available. Western pine lumber is prohibited except for cer-tain millwork. The use of lead and lead products is prohibited except for certain specified uses such as solder for joining purposes, paint and certain processing uses.

Changes have been made in the equipment list (Appendix II). A new paragraph has been added specifying what equipment may be bought with the rating assigned. This provision states that ratings assigned on authorizations issued on or after February 17, 1945 may not be used to get furniture controlled by Orders L-13-b, L-260-a, or L-49. In addition the equipment lists have been amended to bring them up to date with other orders. Equipment that is fired by oil or by natural gas must now be specifically listed on the WPB-617 application form.

Copies of Construction Limitations (Schedule A to CMP Regulation No. 6) as amended February 17, 1945, are available at all WPB district offices, and



NEWLY ORGANIZED Kansas Shall Chapter, NECA, is ably managed by Charles W. Page (left) at Topets, John J. Benner, Shelley Electric Ca. Wichita, is a prominent member of the group.

should be consulted by all builders holding a Form GA-1456, irrespective of when such authorization was issued, WPB said.

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The initial step toward instituting local rural electric re-inspection was taken recently at the annual meeting of the South Central Electric Association, St. James, Minnesota. This R.E.A. group passed a resolution calling for re-inspection of farms connected to the Association lines. While the resolution is not mandatory, the vote appeared to be 100 percent in its favor.

The South Central Electric Association has some 1,060 miles of line serving approximately 2,300 meters in the rural sections of Blue Earth, Cottonwood, Jackson, Martin and Watonwan Counties,

Plans for the re-inspection program are to be formulated by Project Superintendent Meiers and R.E.A. Inspector Brehmer.

WPB TO DECREASE LEAD STOCKPILE

The War Production Board has announced that it plans to dip into the nation's stockpile of lead to bolster essential civilian requirements.

WPB reported that 25,910 tons from the stockpile would be "tentatively" allocated in the second quarter of 1945. This allocation would increase amounts of lead previously allocated for civilian batteries by 14,000 tons, while lead for cable coverings would be upped 6,300 tons, tetraethyl of lead 4,500 tons, and collapsible tubes 1,110 tons.

However, the requirements committee has definitely authorized increased allocations only for the month of April, WPB caphasized. These definite authorizations include 4,666 tons for batteries, 2,100 for cable covering, 500 for tetraethyl of lead and 370 for collapsible tubes.

Definite authorizations for the balance of the second quarter of 1945 will be considered at the next meeting of the recements committee on metals, around the middle of April.

It is expected that the decrease in the ted stockpile will be offset by increased conduction through channeling additional appower to the primary and secondary ead smelters, WPB spokesmen reported.

BRITISH WILL WIRE LEND LEASE HOUSES

The War Production Board has allotted materials to the Foreign Economic Ad-



WITH KLEINS



This book on the care and safe use of tools will be sent on request.

• Extension of communication lines and power lines—improvements in existing services—are waiting for the men and materials now so vital to complete victory. When that time comes, Kleinmen will be back on the job doing their part to aid the rapid transition from a war to a peacetime economy.

Serving these men will be the sturdy, reliable equipment carrying the name Klein so familiar to linemen and electricians since the first wires were strung nearly a century ago.

Today, Mathias Klein & Sons are producing the equipment they have always made—only more of it. This production will be available to serve peacetime industry as soon as war conditions permit.



ASK YOUR SUPPLIER
Foreign Distributor: International Standard Electric Corp., New York

Mathias

Established 1897

SECOND BELMONT AVENUE, CHICAGO 18, ILLINOIS



Give Lasting Lasting Protection

These fuses are especially desirable for use in industrial plants to aid production and save maintenance time. They are designed primarily, of course, for use with apparatus having plated fuse clips; but they can also be used in brass

or copper clips and will give better service than ordinary fuses.

No matter how long Silvend Fuses remain in service, the silver maintains good electrical contact, and heating due to oxidation does not occur. These fuses also have all the good features of standard G-E non-renewable fuses.

For further information on G-E Silvend fuses with silver-plated contact surfaces see the nearest G-E Merchandise Distributor or send the coupon for a descriptive folder.



SEND FOR THIS FOLDER

BUY WAR BONDS AND HOLD THEM

Approved by the

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3 to 600 Amp.,

250 V. or 600 V.

General Electric Co. Section D451-8

Appliance and Merchandise Dept., Bridgeport, Conn.

Please send me the folder on G-E Silvend fuses.

Address

GENERAL & ELECTRIC

ministration, for the production of 30,000 pre-fabricated temporary emergency houses for England, S. W. Anderson, Program Vice Chairman and chairman of the Requirements Committee of WPR. has announced. The houses will be constructed in this country at a cost estimated at \$50,000,000 under lend-lease to England. Wiring and some other facilities will be provided there.

The design of the houses has been carefully screened, WPB said, to reduce to a minimum the use of critical materials including lumber, and procurement of the buildings will be undertaken by the Federal Public Housing Authority, of the National Housing Agency, acting under

a directive from FEA.

Explaining the reason for the allocation, Mr. Anderson said:

"During the course of the war up to September 30, 1944, over 450,000 individual houses were destroyed in England, to the extent of being totally uninhabitable, and a further 4,000,000 were damaged to a greater or lesser degree.

"As a result of this damage, a very large number of persons are homeless in England, or living in one undamaged room in their home. Many persons have continued to live in the subways of London, for want of some shelter, while others have doubled up with other fami-

Mr. Anderson said that the initiation of a temporary building program has been a matter of utmost concern to the British Government for some time, and that the request for our pre-fabricated houses was due mainly to the acute labor shortage in England, where all available manpower has been directed into essential war work -shells, guns, planes and tanks needed to crush the Germans and Japanese.

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He said the whole question of construction of the houses had been examined by WPB and FEA for the last two months, and that on February 9 the allocation of the necessary materials was made by



RELAXED with a favorite pipe and a good book on electronics, Paul Caroll. Harrisburg, Pa., gets set for a quiet evening of study at I.B.E.W.'s National Electronics School, Marquette University, Milyvaubee Paul returned to his con-Milwaukee. Paul returned to his contractor employer at the end of the count.

the WPB's Requirements Committee.

"The materials for these houses will come out of the allocations that would otherwise have been made to our own civilian economy, and will represent practically no impact upon the military effort," Mr. Anderson said, adding that the urgency of the need of the people of England for a partial solution to their severe shelter problem exceeds the urgency of the need of the civilian economy of our country for these materials.

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"The British and American public,"
Mr. Anderson said, "should both realize
that the houses, while providing reasonable comforts, will lack certain details
that a similar peacetime dwelling would
have. For example, certain closet and
cabinet doors will be omitted, and gutters
and leaders will be lacking. Moreover,
the house itself will compare in size to
war housing constructed in this country
for similar purposes. The British are
furnishing certain components for these
houses, including, among others, the heating facilities, electrical wiring and glazing."

WPB ORDERS CONSTRUCTION STOPPED ON DETROIT BUILDING

Unauthorized conversion of a Detroit building into a general hospital at a cost exceeding \$12,000 has been cited by the War Production Board's Compliance Division as a willful violation of WPB's construction order L-41, which imposes a \$1,000 limit on such construction, WPB has reported.

Suspension Order S-736, effective March 12, 1945, states that Mrs. B. J. Pollis, doing business as Lakeview General Hospital at 14742 East Jefferson Avenue, Detroit, Mich., began converting her premises into a hospital about August 24, 1944. She was aware of the expenditure provisions of Conservation Order L-41, WPB officials said.

When the War Production Board ordered the construction stopped, \$12,405 had already been spent by Mrs. Pollis on the hospital, WPB reported. A small portion of this amount was probably chargeable to maintenance and repair, officials said. However, unauthorized diversions of critical war materials had been made to the hospital structure, they emphasized.

Cessation of all construction on the premises, including completion, alteration or installation of any equipment or plumbing and electrical fixtures was ordered by WPB, until specifically authorized in writing.

QUESTION AND ANSWER BULLETIN RE UTILITIES ORDER U-9

The Office of War Utilities, WPB has issued a third Question and Answer Bulletin in connection with Utilities

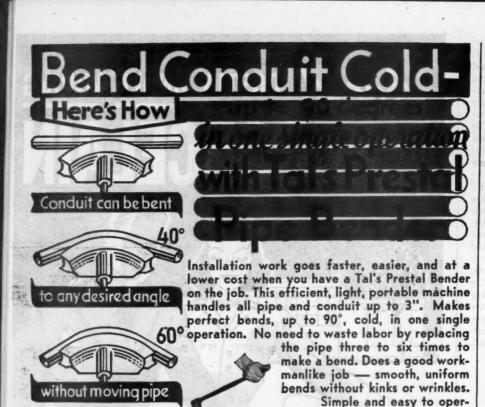


Don't saddle the home owner with H.C.U.W. (High Cost of Under Wiring)! Remember—a home wired without sufficient capacity for anticipated load means money out of the home owner's pocket in the added cost of operating electrical appliances, plus the fact that those appliances do not operate with the efficiency and satisfaction originally intended. Lamps do not burn as brightly, cooking equipment heats more slowly, motors run more

slowly, current costs increase; also there's an increase in blowing of fuses, overheating of wires, burning of switches, fire hazards.

Wire wisely today for tomorrow's load—use PORCELAIN Protected (knob-and-tube) Systems! Non-metallic wiring and non-metallic wiring materials get the OK of your community's efficient Electrical Inspector—the man with helpful fire-prevention facts at his fingertips. Write for wiring manual.





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Tal's Prestal Bender, Inc.

Dept. EC-4, Milwaukee 2, Wisconsin

cessful use everywhere. Write for data bulletin.





HITTING THE BOOKS in a relaxed fashion, R. T. Seiden, Tampa, Pla. and E. L. Batchelder, Columbia, S. C., take part in an evening botel-room study session at the I.B.E.W. National Electronics School in Milwaukee.

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Order U-9, the brownout order. The new bulletin answers the following eight questions that have come from consumers and WPB field offices regarding application of the order's prohibitions on the use of electricity:—

Q. To whom does a consumer apply for permission to light necessary directional or identification signs not automatically allowed under paragraph (c) (7) (i) or (ii) of the order?

A. Consumers must apply for certification of the necessity of the lighting to the local public authority. The local public authority certification for these signs must be made in writing to the consumer's electric supplier.

Q. To whom does a consumer apply for relief from restrictions of Utilities Order U-9 other than paragraph (c) (7) (i) or (ii)?

A. All other consumer appeals for relief from the restrictions of Utilities Order U-9 must be filed with Field Offices of WPB on Form WPB-4113. If the appeal is for reasons of public health or safety the necessity for the prohibited lighting must be certified to by local public authority in the appropriate space of Form WPB-4113.

authority in the appropriate space of Form WPB-4113.

Q. Is lighting permitted in stem windows if the lighting results from the display in the window of electrical mechandise, such as portable lamps in a furniture store window?

A. No. Any type of lighting in show windows other than lighting necessary in interior illumination is prohibited by the Order.

Order.

Q. To what extent is the lighting circuses, carnivals, amusement parks, in and similar outdoor enterprises restrict by the provisions of Utilities Order U.9

A. All general illumination certimal by local authority to be required for public health and safety will be permitted an appeal to the District Office of the War Production Board. Riding devices an permitted the necessary lighting for ticket booths, entrances and exits, loading platforms, machinery operation, and safety and signal systems. Games, sideshows, merchandise and eating stands are primitted the necessary lighting for extrances, exits, ticket booths, and interior

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Electrical Contracting, April 1945

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illumination. However, all ornamental, ign display and other promotional lighting such as outline, border, sign board and panel lighting is prohibited.

Q. May the following businesses and dive enterprises be allowed lighting for identification and direction signs without certification to the electric supplier under paragraph (c) (7) (i) or (ii) of Utilities Order U-9?

City Halls
Post Offices
Court Houses
Health Departments
Religious Organizations
Y. M. C. A.'s
Y. W. C. A.'s
Red Cross Establishments
Fraternal Organizations

A. No, except those which include lodging facilities or a doctor's office and would thus qualify under paragraph (c) (7) (ii) permitting them one 60 watt directional or identification sign or, under Direction 1, one such sign per public entrance in the case of hotels and public lodging establishments.

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Q. Are strings of border lights along or about the street or property frontage of outdoor establishments permitted under

A. No. Such string lighting is considered to be advertising, ornamental, display, or decorative and is not permitted whese no other general illumination is valiable and then only the amount necessary for the conduct of business is allowed.

Q. Is it permissible to provide any show window lighting by increasing interior illumination through the installation of additional lights directly back of the window, or by increasing the general interior illumination, or by installing spot lights in the interior to reflect into the window or by locating floor or table lamps either in or directly back of the show window?

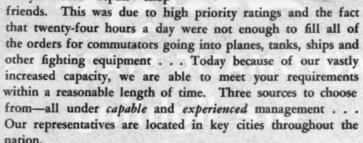


SUDE RULE SECRET'S are divulged by Gilbert A. Blackwood, Muncie, Ind., a be carries out a public speaking assignment at the I.B.E.W.'s National Electronics School at Marquette Unimity. This class is added to prime students for their tasks as Local Union instructors.



A MESSAGE to Electric Motor REPAIR MEN

For the past three years it has been extremely difficult for us to fill orders from our many motor repair shop



Over Ten Million Since Pearl Harbor

TOLEDO STANDARD COMMUTATOR CO. - Toledo 6, Ohio
HOMER COMMUTATOR CORP. - Cleveland 3, Ohio
HILLSDALE COMMUTATOR CO. - Hillsdale, Michigan



St. Louis 7, Missouri

A. No. The installation of any substitute or additional illumination which lights show windows is considered promotional lighting and therefore is prohibited by Utilities Order U-9. Show window lighting for the purpose of the Order is any lighting in or of a show window.

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Q. A clarification has been asked on cerning the lighting permitted for gaso line stations previously discussed in Quetions 28 and 55.

tions 28 and 55.

A. Pump and pump platform or island lighting necessary to transact business is permitted. Lighting of the globe identifying the brand of gasoline sold is prohibited unless the bulb which illuminates this globe also illuminates the dial, or unless the globe is the only illumination available for carrying on the business. Flood or spot lighting is considered premotional and is prohibited by Utilities Order U-9 unless no pump or pump platform or island lighting is available.

THOMAS HEADS SOUTHEASTERN NISA

T. T. Thomas, Electrical Equipment Company, Richmond, Va., was elected president of the Southeastern Chapter, National Industrial Service Association at a recent meeting of that group. Other officers chosen to guide the activities of the Chapter during 1945 are: vice-president, B. A. Siddall, Sumter Machinery Company, Sumter, S. C.; and secretary-treasurer, J. G. Hammond, Hammond Electric Company, Rocky Mount, N. C.

NO INCREASE IN BUILDING CONSTRUCTION CONTEMPLATED

No increase in the volume of building construction in 1945 as compared with 1944 is contemplated, War Production Board officials informed the Hardware Industry Advisory Committee at its recent meeting. Reduction in civilian construction will probably be necessary until the war in Europe is over they said.

Heavy ammunition programs have increased requirements for sheet brass in beyond current production, a representative of the Copper Division said. But and tube brass is also in short supply, with demand in excess of production. She brass is used by the hardware industry chiefly for making keys. It may be necessary to revert to the use of zinc for this purpose, the committee was informed.

The supply of cadmium is sufficient only for military needs, and none is available for civilian uses, an official of the In Lead and Zinc Division said. There is no possibility of removing present restrictions on cadmium plating for hardware.

In view of the present materials supplied in Schedule (builders' finishing hardware) of Orde L-236 (hardware simplification) can be expected.

TIGHTER CONTROL ON COMMENCED STATE STEEL SALES EXPECTED

Some tightening of controls over the sale of steel from warehouse stocks may be expected, in the face of expanding war demands, members of the General Steel Warehouse Industry Advisory Committee were told by War Production Board officials at a recent meeting.

WPB approval has already been temporarily suspended, WPB officials said, on warehouse sales of critical steel products on an "ex-allotment" basis, under Direction 44 to Controlled Materials Plan

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William B. Todd, Director of WPB's Steel Division, told members of the committee that mounting military needs reouired WPB to screen carefully all steel requirements to insure that urgent war demands were satisfied.

A sizeable increase in warehouse steel inventories, which had been built up in the fourth quarter of 1933, has largely melted away during the early part of 1945 as a result of heavy war orders, according to J. R. Stuart, chief of the Steel Division Warehouse Branch. He also said that warehouse inventories have been depleted by rail embargoes and by the fact that purchasers had not allowed sufficent lead time when placing mill orders with consequent greater demand on warehouse stocks.

REUSABLE IRON AND STEEL COMMITTEE HOLDS MEETING

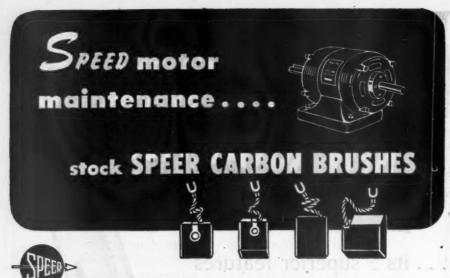
Steps to be taken to bring the sale of all used iron and steel products under one regulation were discussed by the Reusable Iron and Steel Industry Advisory Committee at its recent organizational meeting at Washington, D. C. with offic-

als of the Office of Price Administration. The committee recommended to OPA that it revise Maximum Price Regulation 310-Reusable Steel Shapes and Plates, Shafting-so that it alone serves for pricing of all used iron and steel products. Such a revision would necessitate a transfer of some used iron and steel prices covered in Revised Price Schedule No. 49-Resale of Iron and Steel Products. The latter wiuld then cover the resale of new products only, regardless of source. This differentiation between used and new iron and steel products would likevise apply when Government surplus is involved. The sale of new government surplus iron and steel products is covered by Revised Price Schedule 49—Resale of lion and Steel Products—and Supplementary Order 94—Sales by Government Agencies and Resale of Certain Buyers on all Commodities except Food.

Discussions of the contemplated revision of MPR 310 also covered present pricing, the addition of other items, definitions, local and inter-city delivery

costs-especially on small lots-and re-conditioning costs.





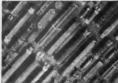
When motors, generators and other commutating equipment need new brushes, be Johnny-on-the-job by having the Speer line on your shelf. Means faster, better service to your customers-builds new business for you. Speer has specialized in carbon brushes for nearly 50 years—is widely and favorably

CHICAGO . CLEVELAND . DETROIT MILWAUKEE . NEW YORK . PITTSBURGH known for quality products. There's none better. Let us tell you how to add this extra service, get the extra profit. Write today.



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Ward Leonard Controls have an enviable record of performance in war equipment. On the sea, under the sea, on the ground, and in the air-subjected to widely varying climatic conditions in all parts of the world!

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RECOMMENDATIONS FOR POSTWAR PUBLIC WORKS CONSTRUCTION

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Edward P. Palmer, chairman of the Construction and Civic Development Department Committee of the Chamber of Commerce of the United States, recently presented seven recommendations regarding postwar public works construction to the House Subcommittee of Public Works and Construction, a part of the Special Committee on Postwar Economic Policy and Planning.

In normal times, Mr. Palmer pointed out, public works construction accounts for only one-third of the total volume of construction, the other two-thirds being privately financed. "Important as the contribution of public works has been and will be to the industry, and hence to the national economy," he stated, "it is evident that measures to encourage privately financed construction are even more important.'

Looking at postwar expectations, Mr. Palmer estimated that, after urgent work necessarily postponed has been completed, public works construction cannot be expected to account for more than between three and one-half and five percent of the total national income and employment Expansion beyond these limits would in his opinion, "lead to pyramid building for which older civilizations have been so universally condemned."

Mr. Palmer's recommendations are: Sponsorship of various classes of public

works by federal, state, and local governments should be clarified. Recent stresses and pressures have blurred the division lines, which should be redrawn to establish the basic principle that the federal government will finance only those public works which lie within its jurisdiction or fields of direct responsibility. All other public works should be financed by state or local governments.

The federal tax structure should be revised so as not to hamper the ability of state and local governments to achieve financial independence.

Congressional scrutiny of federal public works projects should be broadened to include careful consideration of the overall budgetary picture, to assure better consideration of needs, costs, and the ability of the taxpayers to meet the bill

Construction through competitive contracts should be more widely used to assure economy and clarify costs.

State and local governments should cooperate with the federal government in the advance planning of public works in order to be ready for the transition period when materials will be available and additional employment essential.

The federal government should collect and make available continuously current statistics on both public and private construction volume and employment as a practical first step towards stabilizing construction activity.

Private construction should be stimp lated by revising tax policies to remore deterrents to expanding activity. Specfically, provision should be made for atcelerated depreciation, deferred mainte nance and postwar reserves for recorversion construction and planning.

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Electrical Contracting, April 1945

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At the annual meeting of the Oklahoma State Chapter, National Electrical Contractors Association, held at Oklahoma City, Okla. on February 18, the following officers were elected to serve for the coming year:

President, L. T. Allen, Allen Electric Tulsa; vice president, George A. Gaddis, Gaddis Electric Co., Oklahoma City; treasurer, H. J. Reeves, McEl-downey & Son, Oklahoma City. The Executive Committee consists of the above officers and Marvin Osborne, Osborne Flectric Company, Oklahoma City; Dale Watt, Watt Plumbing, Air Conditioning & Electric Co., Tulsa; Guy Emerson, Guy Emerson Company, Tulsa; and Harold Walker, Walker Electric Co., Enid.

SHORTAGE OF SKILLED WORKERS

Unless there is an immediate and marked increase in the number of young men being trained for cratfsmen in the construction industry to replace those who are retiring because of increasing age, the industry in destined for a serious shortage of skilled workers. This forecast, with supporting evidence, is graphically presented in a statistical study which was submitted by Apprentice-Training Service, War Manpower Commission, at a recent conference of the Executive Committee of the General Committee on Apprenticeship for the Construction Industry.

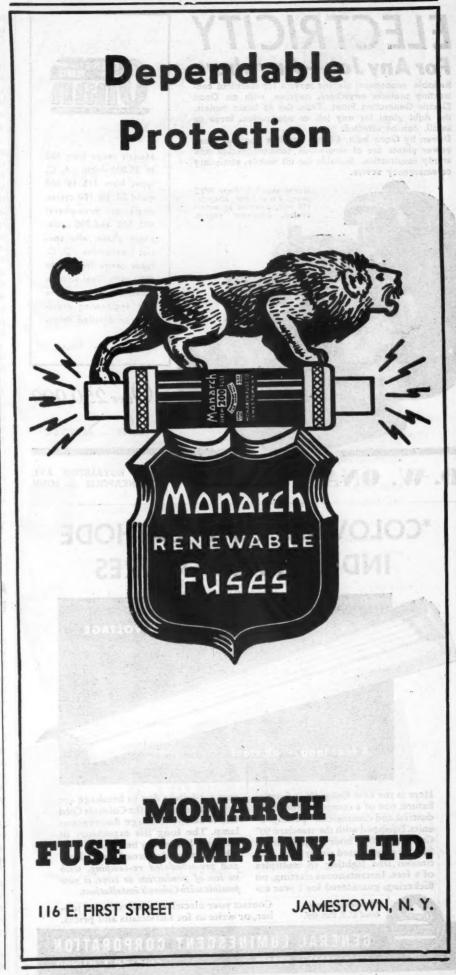
According to the ATS study, the average age of skilled construction men has increased from about 38½ years in 1900 to 43 years in 1940; and the proportion of youths under 20 years old being trained to replace the older age group during this

period dropped fully 6 percent.

"If those workers 65 years of age or older," the report states, "were suddenly to retire as a group, several of the building trades would not have anywhere near enough beginners to replace them. If those who die or retire before age 65 were added, the insufficiency of replacements would be even more obvious. If projected plans assume, in addition, an expanding construction economy, the actual ratio of replacements becomes completely inadequate.

"If age trends continue as they have done for the past 40 years, we may anticipate a serious shortage of skilled construction workers in a relatively short time. We must train construction apprentices now, and in fairly large numbers so that 34,000 will complete their training each year."

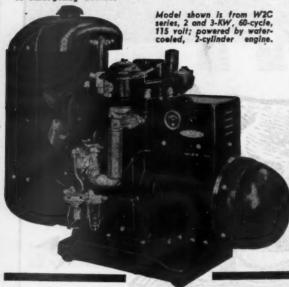
To increase as rapidly as possible the number of apprentices required to meet the emergency, specific plans have been made nationally and locally, according to the conference report, to further the employment of returning veterans for this training. Employment of veterans will not only help the industry to offset the scarcity of young men eligible for apprenticeship who are available on the home front, but will provide career oppor-



ELECTRICITY For Any Job—Anywhere

Reliable, economical electric service for electrical conreacting projects anywhere, anytime, with an Onan Electric Generating Plant. From the 65 basic models, the right plant for any job or application, large or small, can be selected.

Driven by Onan built, 4-cycle gasoline engines, these power plants are of single-unit, compact design and sturdy construction. Suitable for all mobile, stationary or emergency sevice.



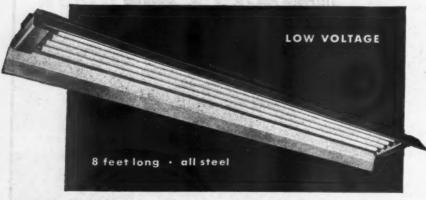
Models range from 350 to 35,000 watts. A. C. types from 115 to 660 volts: 50, 60, 180 cycles, single or three-phase; 400, 500, and 800 cycle, single phase; also special frequencies. D. C. types range from 6 to 4000 volts. Dual voltage types, available. Write for engineering assistance or detailed litera-

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Here is the new Colovolt industrial fixture, one of a complete line of industrial and commercial "packaged" units. Equipped with the standard 93" Colovolt 10,000 hour lamp, Colovolt fixtures may be used singly or in continuous line lighting in multiples of 8 feet. Instantaneous starting, no flickering, guaranteed for I year ex-

cept for failure due to breakage are extra advantages of the Colovolt Cold Cathode low voltage fluorescent lamp. The long life expectancy of Colovolt lamps may be realized even when constantly turned on and off, and pre-scheduled re-lamping, with no loss of production or time, is now possible with Colovolt installations.

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Contact your electrical wholesaler or job-ber, or write us for full details and prices.

GENERAL LUMINESCENT CORPORATION

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tunities to veterans who qualify. Plans are outlined in the report whereby the General Committee on Apprenticeship for the Construction Industry, Apprentice-Training Service, State apprenticeship agencies and the Veterans Administration may work together under a uniform policy in the employment of ex-service men who express a desire to train for construction work.

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The conference report also outlines plans of the general committee for increasing the cooperation and activities of ioint apprenticeship committees in every locality, and the establishment of additional joint committees to carry on this important undertaking. Special emphasis is given to the establishment of national, as well as state joint apprenticeship committees, in each of the building trades, so as to create an all-inclusive system of apprenticeship in the construction industry throughout the United States. National apprenticeship committees are already established in five building trades—carpentry, electrical, painting and decorating, plumbing and steamfitting.

The following members of the Executive Committee were present at the conference:

John E. Rooney, President, Operative Plasterers and Cement Finishers International Union; E. H. Herzberg, Chairman, Apprenticeship Committee, National Electrical Contractors Association; L. M. Rafferty, Secretary-Treasurer, Brother-hood of Painters, Decorators and Paperhangers of America; George S. Stuart, Executive Director, Painting and Decorating Contractors of America; and Marion H. Hedges, Director of Research, International Brotherhood of Electrical Workers

AMENDMENT 4 TO REVISED PRICE SCHEDULE 40

A jobber's mark-up on new types of builders' hardware first offered for sale by him after March 3, 1945, is limited to 331 per cent applied to the manufacturer's maximum price of the product-plus actual transportation charges paid by the jobber for delivery-the Office of Price Administration has announced.

Before this amendment, which became effective March 3, 1945, the 331 per cent mark-up, plus transportation, could be added to a jobber's cost for the producteven though he had bought from another jobber who had also taken a 331 per cent mark-up.

Limiting the mark-up to the manufacturer's maximum price, plus actual delivery charges, will eliminate pyramid-ing of mark-ups by jobbers, which re-sulted in higher prices to users, OPA said.

So that jobbers can properly compute legal ceiling prices, today's amendment requires manufacturers of new models of builders' hardware products to notify all purchasers in writing of the producers

maximum prices for the new products.
(Amendment 4 to Revised Price Schedule 40-Builders' Hardware and Insect Screen Cloth-effective March 3, 1945.)

SENATE SMALL BUSINESS COMMITTEE STUDIES CONSTRUCTION PROBLEMS

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Federal, State and local governments should cooperate with and give the construction industry every aid in preparing for quick resumption of high levels of construction activity immediately after sharp cutbacks in war production, Senator James E. Murray, of Montana, chairman of the Senate Special Committee on Small Business, stated recently in announcing the developing plans of the committee in the study of construction industry problems

This industry offers more widespread opportunity for expansion of small business than any other non-agricultural ininstry, Senator Murray said, recalling that in the past, the construction industry has directly and indirectly, privided from six to nine million jobs annually. Wartime restrictions on construction, however, have reduced the operations of the industry to the lowest level since 1933. The committee, therefore, is undertaking a study of the industry with particular reference to the part which small business can play in speeding the end of the war, in the smooth transition from war to peace, and in expanding opportunities for postwar employment.

The industry must be so organized as to provide as rapidly as possible the annual level of building, construction, and repairs which most nearly meets the nation's crying need for adequate dwellings, structures, and roads, the Montana Senator pointed out. He believes that this industry, as with all other elements in the conomy, must be so organized as to assume its maximum role in developing fully our resources of men and materials.

Senator Murray continued: "The industry is operating at such low levels that purposeful action must be taken now to enable it to recover lost ground as quickly as possible once Germany and Japan are defeated. Action taken now will go far towards assuring jobs promptly to returning soldiers and reducing unemployment which may result from cutting back of war production.

"The construction industry has normally been subject to violent fluctuations in the annual volume of work done. In the best interests of the nation as a whole, seasonal and cyclical swings in construction activity and, consequently, employment, should be stabilized at the highest level of output without fostering restraints upon free competition.

"Intensive examination of basic problems will be undertaken by means of studies and public hearings in order to determine what steps by the government as well as by industry and labor are required for stabilization of construction at high levels of activity providing at all times an optimum share of full employment for all people willing and able to work."

From preliminary negotiations already made, the committee feels that it will receive the benefit of the best thinking of individuals and organizations comprising the construction industry, organized labor,



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ECONOMICAL OPERATION

YEARS OF GOOD SERVICE

Prompt delivery on orders rated AA-5 or Higher.

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M2
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Switch Capacity 50 A. at 125 V. 50 A. at 125/250 V. 50 A. at 125 V. 50 A. at 125 V. Case 16 Ga. Steel 16 Ga. Steel Cast Iron Cast Iron

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RELIANCE AUTOMATIC LIGHTING CO.

FURNISHES FINE BRUSHES
AND BURNISHERS...
To give you the proper finishing touches to motor repairs and final commutator turning jobs. Easy to use carbon brushes and burnishers that do the work while the machine is running are listed in the Blue Catalog.

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and other interested groups. Working under the direction of Dewey Anderson, executive secretary to the committee, Frank Piovia has been selected as consultant to coordinate the studies. Other specialists in the construction field from WPB and non-government agencies will cooperate in consultation in the work of the committee.

RELAXATIONS IN WPB ORDERS

The War Production Board recently issued a list of summaries of modifications of WPB orders during January 1945. WPB cautions that anyone wishing to take appropriate actions under these orders should consult the official copies of the full orders.

The list included Amendment L-176, L-65-a, -17-45, Electric Fans and Irons for Veterans Administration. The Veterans' Administration was added to the list of government agencies entitled to place preferred orders for electric fans and for electric irons.

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ESSENTIAL ACTIVITY LIST TO BE USED BY LOCAL BOARDS

National headquarters of Selective Service has sent a letter of instructions to local boards outlining the procedure to be followed in carrying out the recommendations of the Director of War Mobilization and Reconversion in determining the men to be selected for the armed forces in the 26 through 29 year old group. The letter reads in part as follows:

"Since the armed forces need young men and since the supply of those in the age group 18 through 25 is practically exhausted, a substantial part of our calls from this time on will have to be filled with men in the age group 26 through 29. There are only 828,000 men in this age group now classified in Class IIA or Class II-B. Those who are selected for service in the armed forces must be taken as nearly as possible in the order of their essentiality, the least essential being taken first.

"The Director of War Mobilization and Reconversion has recommended that the essential activity list be used as a guide in determining the men to be selected for the armed forces in the age group 26 through 29, and that they be taken to the fullest extent possible in the following order:

(1) registrants not employed in an activity appearing on the essential activities list.

(2) registrants whom the local board finds to be employed in relatively unimportant jobs in essential but not critical activities.

(3) registrants whom the local board finds to be employed in relatively unimportant jobs in critical activities.

(4) registrants whom the local board



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BENEFITS of contractor cooperation are related by J. A. Peterson (left), Cotton States Electric Co., Atlanta, Ga., as he chats with W. Reid Puckett, mgr., Atlanta Chapter, NECA.

finds to be engaged in relatively more important jobs in essential activities.

(5) registrants whom the local board finds to be engaged in more important lobs in critical activities.

"If however, you find that a replacement is available for a registrant, he should be classified as available for induction regardless of his place in the groups listed above."

HOLDEN COMPANY MOVES

H. A. Holden Company, Minneapolis, distributors of motor repair parts, pulleys, belts and shop equipment occupied new headquarters in the city on March 15. Their new location at 1208 Harmon Place provides much needed additional floor space and better parking facilities for customers.

MINNESOTA ELECTRICAL ASSN. NOW INCORPORATED

The cycle of organizing on a permanent basis those groups which constitute the Minnesota Electrical Council, Inc., was recently completed with the incorporation of the Minnesota Electrical Association (state group). Final steps in the procedure was ratified by the former executive committee of the state association and the board of directors of the newly incorporated successor at meetings held in Minneapolis, Feb. 21-22.

Organized as a sectional group in Southern Minnesota in May, 1928, the Minnesota Electrical Association dropped the "Southern" designation in 1932 when electrical contractor groups in western and central Minnesota and Duluth joined to form a statewide association representing the common interests outside the Twin Cities area. In 1933, this state group



40 Years' experience plus modern design is built into every R&S product.

R&S reflector contours are scientifically designed with high reflection factor providing a maximum of safe controlled light at minimum cost.

Thorough inspection and rigid factory controls insure longer life and low maintenance.

R&S explosion-proof lighting fixtures are supplied with a standardized base common to all sizes. Reflector globe assemblies of various capacities are interchangeable to suit conditions. No need to disturb mounting or electrical connections. Modern design simplifies mounting and affords a variety of conduit arrangements in one standard base. Installation costs are lower, parts fewer and ordering easier.

In hazardous areas, you can't afford to experiment. R&S explosion-proof and vaportight lighting fixtures are precision built and pass the rigid tests of Underwriters' Laboratories.

Specify R&S and be sure. Write for our 300-page catalog. You will find it valuable in planning new work and bettering existing installations to meet tomorrow's standards.



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AVAILABLE

Let's get set now for Postwar

GARDEN CITY PLATING & MFG. CO., INC. Ogden Blvd. & S. Talman Ave., Chicago 8, III.



DISCUSSING the new National Electrical Code changes at the recent meeting of the Illinois Chapter, IAEI, in Chicago are (L-to R): E. P. Hodges, supt., meter department, Public Service Co. of Colorado, Denver; Frank Hanlin, associate electrical engineer, Underwriters' Laboratories, Inc., Chicago; and Wilfred C. Cale, approvals engineer, Canadian Standards Association, Toronto, Canada.

joined with the Minneapolis and St. Paul contractor-dealer groups to sponsor the Minnesota Electrical Council as a central coordinating agency for this branch of the electrical industry. Each of the three groups has remained separately organized. They are now incorporated so they may function individually on matters of local or sectional interest.

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Elects

Officers of the Minnesota Electrical Association, Inc., elected at the Feb. 22 meeting include: president, E. W. Linner, Stillwater; vice-president, M. A. Oien, Cloquet; secretary-treasurer, William A. Ritt, St. Peter. The following were elected as directors of the newly incorporated group: One year term—E. G. Nylund, Duluth; L. E. Shaffer, Pipestone; C. W. Turner, Faribault; two year term—Ed. Karst, Fergus Falls; Ole Hagen, Detroit Lakes; Moreau Bailey, Albert Lea; three year term—G. L. Hauglund, Appleton (Minn.); E. L. Peterson, St. James; John Engle, Rochester.

Representing the group on the board of



ACTIVE in North Carolina's electrical contracting groups are (L to R) Dwight L. Casey, Charlotte, NECA field representative and Herman J. Bryant, Carolina Electric Company, High Point, N. C.



RICHARD VERNOR, Chicago, president, NFPA, commends the Illinois Chapter, IAEI on the wartime job the electrical inspectors are doing to safeguard life, property and materiel, while working under the handicap of substitute materials.

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the Minnesota Electrical Council are: Sam Newstone, Montevideo; John Ellenbecker, St. Cloud; William A. Ritt, St. Peter; E. G. Nylund, Duluth; and Ed Karst, Fergus Falls.

SACHS HEADS ST. LOUIS CONTRACTORS

S. C. Sachs, S. C. Sachs Company, was elected president of the Electrical Contractors Association, St. Louis Chapter, NECA, at the recent annual meeting of that group. F. A. Rick, Rick Electric Co., was chosen vice president and Ed Mueller, Briner Electric Co., treasurer. Serving with the above officers on the Board of Directors are Carl I. Schaeffer, Paul Wendt and E. O. Dorsch.

SHAFFER PILOTS MINNESOTA ELECTRICAL COUNCIL

L. E. "Larry" Shaffer of Pipestone, Minn., was elected president of the Minnesota Electrical Council at the annual meeting of the board of directors on Feb. 22 at Minneapolis. Other officers chosen for the 1945 term include: Vice president, Eric G. Nylund, Duluth; treasurer, F. M. Tripp, Minneapolis; secretary-manager, William A. Ritt, St. Peter.

The following were designated as directors-at-large (in addition to the directors chosen by the groups sponsoring the Council) for 1945: J. W. Hruska, Mankato; Louis H. Gordon, Albert Lea; Ed. Raetz, Rochester; Charles Wood, Fargo (N.D.); Paul Schorr, Sr., St.



Lighting engineers, maintenance men and workers are enjoying more efficient fluorescent lighting by using G-E Watch Dog Starters. These manual reset starters have provided the utmost in all-around fluorescent lighting service in war factories all over the nation.

Why these three prefer G-E



LIGHTING ENGINEERS—specify G-E Watch Dog Starters because of their unusually long life. The Watch Dog outlasts five ordinary starters. This is equivalent to approximately three years of lighting service.



Watch Dog Starters because they reduce fluorescent lighting maintenance to the simple job of pressing a red button before relamping. Reset it . . . forget it.



WORKERS—are more satisfied with lighting fixtures equipped with G-E Watch Dog Starters because they banish annoying blink and flicker of dying lamps. Blinking cannot possibly recur once the Watch Dog Fluorescent Starters lock out.

Would you like to know more about G-E Watch Dog Starters? Write for our bulletin "How to Use Fluorescent Accessories for Best Lighting Results." Send your request to Section G452-8, Appliance and Merchandise Dept., General Electric Company, Bridgeport, Connecticut.

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NORTON (N) INSTRUMENTS

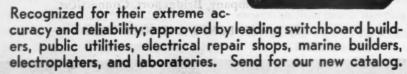
Calibrated for your exact needs



"Because Norton dials are hand calibrated and hand drawn, they are accurate at every part of the scale."

NORTON VOLTMETERS

are built in the careful, painstaking manner which has characterized Norton construction for a half century. Hardened, hand-ground pivots, supported by sapphire jewels for accuracy.



NORTON Electrical Instrument Co. 51 HILLIARD STREET . MANCHESTER, CONNECTICUT

Paul. F. M. Tripp and William A. Ritt were re-elected to represent the electrical contractors on the board of the North Central Electrical Industries.

Reports indicated the Council in the "best-on-record" position. Last year the goal of 50 new members was reached and since Jan. 1 of this year more than 20 new members have joined the organization—a flying start to the 1945 goal of 65.

YOUNGSTOWN LEAGUE ELECTS OFFICERS

At the annual meeting of the Electrical League of Youngstown held on January 22, the following directors were elected to serve during 1945: E. C. Carlson, president, The Carlson Electric Co.; W. H. Gruger, president, the Phoenix Electric Co.; I. E. Christman, district representative, General Electric Co.; W. C. Robinson, district manager, Graybar Electric Co. and M. P. Walsh, Ohio Edison Co.

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A meeting of the Board was held following the adjournment of the annual meeting, at which the following officers were elected—W. C. Robinson, president; I. E. Christman, vice-president and E. J. Beil, secretary-treasurer.

HESS AGAIN HEADS INDIANAPOLIS LEAGUE

Dan C. Hess, Indianapolis Power & Light Co., was re-elected president of the Electric League of Indianapolis, Inc., at a recent meeting of the Board of Directors of that organization.

Re-elected as vice-president was C. H. Domhoff, Guarantee Tire and Rubber



A. F. MATSON, associate enginer, chemical department, Underwriter Laboratories, Inc., Chicago, tells Illinoi electrical inspectors how electrical easily ment is tested and approved for use in hazardous locations.



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MAGNETIC WIRE RECORDER demonstrated by L. Peine (with microphone), G.E. Co., attracted the curious, and the technical minded at the recent Electrical Maintenance Engineers Indusnial Electrical Exposition in Milwaukee.

Company. Other officers elected included: Secretary—C. F. Fitchey, General Electric Supply Corp.; assistant secretary—C. G. Lammers, Westinghouse Electric Supply Co.; treasurer—H. G. Crawford, Allis-Chalmers Mfg. Co.; assistant treasurer—P. G. Winter, American Electric Co.

Representing the various industry groups on the Board of Directors are the following: H. H. Bauck—Appliance Dealers; G. F. Hyde—Appliance Distributors: H. W. Claffey—Contractors; Att Uhrlandt—Manufacturers; F. F. Dietz—Motor Repair Shops; J. O. Mogg—Oil Heating; E. A. Terhune—Service and Maintenance; F. J. Argast—Supply Jobbers; and A. C. Crandall-Utilities.

HEW MISA CHAPTER FORMED

The latest addition to the ranks of the National Industrial Service Association is the recently organized Chapter in Washington, D. C. Known as The Electric Motor Service Association of the District of Columbia, the new group enjoys 100 percent representation of shops in the national capital. Credit for this record goes to Lee Harris, Walter Bailey and J. F. Warfield, among others, who boosted NISA among the motor service those

Officers elected to head the activities of the new Chapter are: president, Henry J. Don, Central Armature Works, Inc.; seretary, H. R. Mullen, Warfield & Sanford, Inc.; treasurer, L. H. Harris, Electric Equipment Company.

NEGA CALIFORNIA CHAPTER ELECTS OFFICERS

J. D. O'Connor, of Sacramento, Calif., was elected president of the Northern California Chapter, NECA. It will be the second time that O'Connor has headed the organization, for in 1938 he was presi-

No Time

for dreaming!

EVERY man and woman of us has enticing dreams of the house-hold appliance business to come, following war's end. That will be an exciting, happy day for all concerned: for the manufacturer who makes them, the dealer who sells them and, probably, most of all, for Mr. and Mrs. Consumer who so badly need so many of those appliances that bring ease and convenience to their home.

But today, this month, this year, perhaps, is no time for dreaming of those things that bring ease and comfort and soft living while there



remains to be done a tough unfinished job. The Office of War Mobilization has flatly stated that civilian goods production must wait upon an over-ample production of those things so vital to winning the war at the lowest cost of life and wealth, in the shortest possible time.

To us that plainly means what it says: that we who serve the war front must stick to our job until that job is done. We at Rittenhouse have had one dictum to guide us—"If we could make door chimes today, we'd still stick to making war goods." For we know that until that first big job is done, there will be no legitimate place in our national economy for door chimes. And that goes for manufacturer, dealer and consumer alike.

Mr. and Mrs., this quite obviously is no time for dreaming tomorrow's dreams.



THE A. E. RITTENHOUSE COMPANY, INC., HONEOYE FALLS, N. Y.



Go after all of the

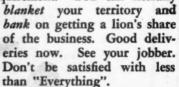
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"Has Everything"

. . . meaning, of course, Talk-A-Phone, The World's Most Advanced and Complete Line of Inter-Communication.

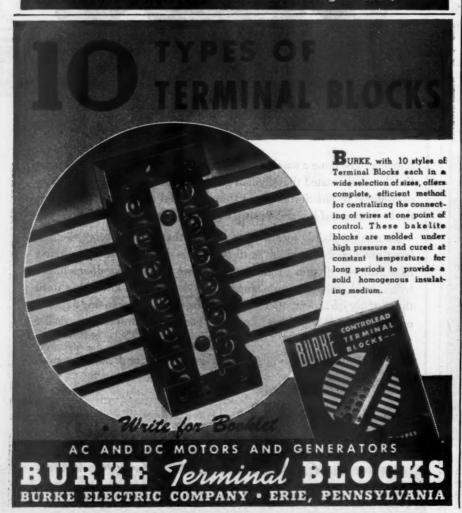
Wherever there is need for Inter-Communication Talk-A-Phone meets it completely... there's a unit for every requirement. You can literally





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dent of the Northern California Electrical Contractors Assn., which later is came the NECA chapter. Tom Dray, Bakersfield, was elected vice-president and William A. Cyr re-elected secretary treasurer. The directors, elected by their individual districts earlier in the year, in clude the above officers and Tom Rollin son, Fresno; Grover Grider, Stockton Edward Pierce, Vallejo; T. L. Rosenber, Oakland, past president (also governor for the chapter); Carl Stolting, Sun Rosa; Seth Cohn, San Mateo; Roy Butcher, San Jose; Wesley Evans, Salinas; George Abbett; Tom Harris; Edward Dowd and Joseph Carlson, all of San Francisco. The election took place at the annual meeting Jan: 26, at which the petition of the San Francisco association for relinquishment of territory to that it might form its own chapter, affiated with the Norhern California Chapter. was voted.

TWIN CITIES CONTRACTORS ELECT 1945 OFFICERS

At the annual meetings of the electrical contractors associations in the Twin Gibs in January, the following officers and directors were elected:

Minneapolis Electrical Contractors Association—president, John Kvalsten; vio-president, W. Arthur Starbird; secretary-treasurer, C. B. Annis. The new directors, in addition to the officers, are George H. Brown, L. E. LeMay and John Morris Representing the group on the Minnesota Electrical Council Board are John Kvalsten, Oscar H. Batzli and F. M. Tripp.

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St. Paul Electrical Contractors Association—president, L. A. Rylander; me president, Wilbur Hoffman; secretary treasurer, August Hanson. Serving with the new officers as directors are D. F. Kehne, Paul Schorr, Sr., Ed Hoffman and Arthur E. Swanson. L. A. Rylander, Ed Hoffman and Arthur E. Swanson to the Minnesota Electrical Council Board.



LABOR RELATIONS in the midset are a prominent phase of the association activities of (L to R) E. L. Santick NECA field representative, Chiquite. H. Herzberg, manager, Milwatta Chapter, NECA; and J. E. Wani, business manager, IBEW Local Discussion of the control of the control

CANADIAN REHABILITATION INCLUDES APPRENTICE TRAINING

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April 19

The Rehabilitation Training School for returned service men in Toronto, Canada, includes a Building Trades School in which all trades of that industry are taught. Building trades are known as "designated" trades and come under the supervision of the Apprenticeship Department of the Ontario Provincial Government. The Electrical Department includes a six months' course in electrical construction and maintenance which is equivalent to the first two years of apprenticeship. The trainee, after completing the course, is placed in industry to finish the third and fourth years. The school is a branch of Canadian Vocational Training, of which H. H. Kerr is the Director for the Province of Ontario. R. F. Thompson is the Dominion Administrator, with headquarters in Ottawa.

MUNGER PILOTS CHATTANOOGA LEAGUE

George D. Munger is the new president of the Electric League of Chattanooga down in Tennessee. Mr. Munger, who is chief of TVA's electrical Development Division and was formerly with REA and EHFA, took over the duties of the retiring president Paul Ramsey.

Assisting President Munger in guiding the activities of the League are the following officers: Harry W. Cameron, first vice-president; W. A. Jewell, second vice-president; Paul J. McMillan, secretary; and J. W. Johnson, treasurer.

Book Reviews

ELECTRICAL DRAFTING APPLIED TO CIRCUITS AND WIRING

To the engineer or draftsman entering the electrical profession, a knowledge of wiring plans and the methods of their execution and development is of first importance. The practiced electrician must interpret the wiring plan and translate it in terms of the finished installation. Every piece of electrical equipment, even a simple bell, must have a controlling circuit. The function of the detailed wiring plan as a pattern for the wiring installation need hardly be stressed.

The author has given special attention to recent advances in the field of electrical drafting; modern methods are introduced early in the book and are adhered to the second of the seco

hered to throughout.

Tested methods as applied to circuits and wiring are presented as a series of illustrated discussions. Simple schematic circuit diagrams are studied first, becoming more complex with a series of graded drawing plates and explanations at the same time developing the detailed wiring plan for several typical cases, and correlating the conduit and equipment loca-







RLM Heavy Threaded Deep Bowl Reflector and Socket Hoods



BLM Threaded Dome Reflector





• QUAD Units have proved themselves in long-time service. Contractors enthusiastically endorse them because they live up to their claims—they give good lighting efficiency for long periods and require little attention. Install QUADS for industrial or commercial installations—indoor or outdoor. Good business is the result. QUAD... for today and for tomorrow.

Manufacturers of Incandescent Lighting Equipment

QUADRANGLE MFG. COMPANY

32 S. PEORIA ST.
CHICAGO 7 ILLINOIS



IBEW WILL NOT approve bare neutral wiring systems, W. D. Walker, international vice-president IBEW (and IBEW alternate on the Electrical Committee), informs the Illinois Chapter, IAEI at their recent Chicago meeting. Active interest in electrical code affairs is being planned by the IBEW, he asserted.

tion plans. In many cases the drawings represent actual working installations.

A few of the chapter titles are: symbols, schematic diagram, circuit and wiring plans, lighting, power, communication, railway signals, radio and television, switchboard wiring plans, animated sign lighting, equipment location and conduit plans, notes and specifications, office practice, drafting links, etc.

It is a book that should be in the hands of every individual connected with the electrical construction industry whether engineer, draftsman, estimator or electrician.

The book is Electrical Drafting—Applied to Circuits and Wiring by D. Walter Van Gieson, and published by the McGraw-Hill Book Company, 330 West 42nd Street, New York, 18, New York, 18, 150

ENGINEERING CONTRACTS AND SPECIFICATIONS

For contractors, practicing engineers and architects this is an authoritative, non-technical guide on the writing of legal-proof private or government specifications and contracts. It includes contract forms, contracting parties' rights and responsibilities, and basic law involved.

An effort has been made to develop basic principles and methods throughout. Legal principles are stated in general terms without derivation and it should be understood that there are many variations in the interpretation and application of the law.

Contract procedure is developed along the lines of private practice but attention is directed to matters in which government procedure differs.

Examples of various contract documents for both private and public works THE "ONE-MAN" HAMMER FOR TEN-MEN'S WORK

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DEPENDABLE

ELECTRIC HAMMERS



"ONE" WORKING PART
—the PISTON

Saves 90% in time and costs
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Four Powerful Models

"MK	-5/8"	Cap.								\$105.00
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AFETY RULES call for that EXTRA precaution and additional RECHECK which SAFE-T-GLOW provides. Detects accidental tie-ins, crossovers, leakages and induced voltages . . . prevents serious injury and loss of life. SAFE-T-GLOW consists of a sensitive Neon tube, amplified by mirror reflector.

Model A for circuits 2,000 to 35,000 volt Model B for circuits from 35,000 to 220,000 volts.

TEST-O-LITE



Equipped with Neon light which tells instantly where trouble liefs circuits, fuses, cut-outs, motors, etc. Indicates het or grounded wirst-Tells AC from DC. SAVES PRECOUSTIME. Has PATENTED sofely features. Vest pocket size with dip Lifetime guarantee. List fries \$1.50 at leading jobbers.

L. S. BRACH Mfg. Corp. 55-63 Dickerson St. Newark, N.



MANAGERIAL PROBLEMS get a thorough airing as (L to R) E. E. Hedler, manager, Philadelphia Chapter, NECA, Philadelphia, Pa., and C. L. Morrissey, manager, South Louisiana Chapter, NECA, New Orleans, leisurely talk shop.

have been included, primarily to illustrate the text rather than for reference purposes. However, they have been selected as representing the best current practice and should act as a guide in the preparation of similar documents for specific projects.

With regard to specification writing, it is recognized that skill in this field depends largely on experience and engineering judgment, for which there are no substitutes. The instructions given in the book are intended to provide a basis for the systematic application of such knowledge and to indicate a form for its presentation.

The book is Engineering Contracts and Specifications, by John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N. Y. at \$2.25.



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hi which sie liestin otors, etc. ed wires. PRECIOUS afety fee-with dispersion of the control of

List Price

Corp

bril 1945

SPOT CONVERSION of alternating carrent for specific machine tool drives is tractical, asserts W. R. Hough, moduct division engineer, Reliance Electric and Engineering Co., Clevelland, as be outlines to the Chicago Electrical Maintenance Engineers, the system used by his company in rewiring their own plant and the application in various war industries. Equipment used was Reliance V-S Drive.



In this modern plant

SORGEL Air-Cooled Transformers are being built to meet the various rigid conditions of war service.

Even though wartime costs are higher, we did not reduce our high quality or liberal design, on which our reputation is built.



1/4 KVA to 1000 KVA. All voltages



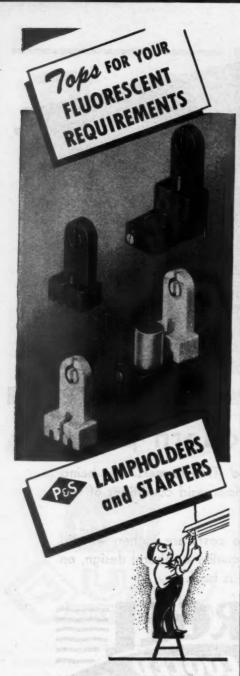
450 KVA 3-phase 4160 volts



Standard ¼ KVA. 1-Phase 460/230 to 230/215 volt

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836 West National Ave. Milwaukee 4, Wis.



If it's Fluorescent Lampholders and Starters you need, turn to your P&S Catalog -Be sure of the dependable performance which has characterized P&S Wiring Devices for over fifty years.

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Catalog on request.

PASS & SEYMOUR, INC. SYRACUSE 9, NEW YORK



VETERAN MECHANIC "Uncle" John Motley uses his years of experience to advantage in Tri-State Armature and Electric Works' field shop at their LCT ship wiring project in Memphis, Tenn. Making special tools and jigs is bis specialty.

Utah Chapter, IAEI—Monthly meeting, Auditorium, Utah Power & Light Co., Salt Lake City, Utah, April 3.
George Washington Chapter, IAEI—Monthly meeting, District Building, Washington, D. C., April 9.
Rocky Mountain Chapter, IAEI—Monthly meeting, Rm. 385, City and County Building, Denver, Colo., April 10.
National Industrial Service Association—Directors meeting, LaSalle Hotel, Chicago, April 16-18. (Annual conference cancelled.)
Utah Chapter, IAEI—Monthly meeting, Auditorium, Utah Power & Light Co., Salt Lake City, Utah, May 1.
National Fire Protection Association—Annual meeting, Palmer House, Chicago, Ill., May 7-11.
Rocky Mountain Chapter, IAEI—Monthly meeting, Rm. 385, City and County Building, Denver, Colo., May 8.
George Washington Chapter, IAEI—Monthly meeting, District Building, Washington, D. C., May 14.
Utah Chapter, IAEI—Monthly meeting, Auditorium, Utah Power & Light Co., Salt Lake City, Utah, June 5.
George Washington Chapter, IAEI—Monthly meeting, District Building, Washington, D. C., June 11.
Rocky Mountain Chapter IAEI—Monthly meeting, Rm. 385, City and County Building, Denver, Colo., June 12.
American Institute of Electrical Engineers—Summer Technical Meeting, Hotel Statler, Detroit, Mich., June 25-29.
National Electrical Contractors Association—Annual conference, Grand Hotel, Mackinac Island, Mich., Sept. 9-15.
International Municipal Signal Association, Inc.—Annual meeting, Hotel La Salle, Chicago, Ill., September 24-27.

CANCELLED OR POSTPONED

Midwest Power Conference — Palmer House, Chicago, Ill., April 9-10.

National Electrical Manufacturers Assn.—Spring Conference, Palmer House, Chicago, Ill., April 16-19.

International Lighting Exposition—Palmer House, Chicago, Ill., April 19-23.

National Electrical Wholesalers Assn.—Spring meeting, April 23-25.

Electrical Committee, N.F.P.A.—Edgewater Beach Hotel, Chicago, Ill., Week of May 14.

INDUSTRIAL LIGHTING NEEDS must be met



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The MULTI line will give you just the right fixture for a job—no after worriez—no expensive maintenance for your customer. The demand for good lighting in industrial plants has been emphasized by our war work—has made us realize that good lighting improves efficiency, therefore the line that has proved itself is your natural choice—that's MULTI of course.

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ON PERFORMANCE ILSCO LUGS

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Deserve a Jewel Box .

Why pay more for the box than the contents? Or, why pay for the extra weight of cast lugs of poor conductivity when you can buy ILSCO PRODUCTS of lighter weight, 99.99% PURE ELECTROLYTIC COPPER AND 100% CON-DUCTIVITY! More efficient . . . more economical . . Underwriters approved . .

Write for 32-page illustrated catalog-

A PRODUCTS,

GENERAL ELECTRIC

E E Potter, who for the past 14 years has been eastern general sales manager of General Electric Lamp Department at Nela Park headquarters, has been elected 4 G-E commercial vice president. Mr. Petter has relinquished his duties at Nela Park and will become a member of President Wilson's staff. Mr. Potter's headquarters will be in Washington,



E. E. POTTER

D. C., where he will be further responsible for providing assistance to the several GE departments and to affiliated concerss in all Company customer relations in the District of Columbia.

P. D. Parker, who has been assistant general sales manager of the lamp depart-ment's Eastern Sales Division, becomes general sales manager of that division. Mr. Parker has worked closely with the War Production Board with respect to all G-E Lamp Department wartime

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General Electric's appliance and merchardise department has formed a new sales district, the Central District, with headquarters in Kansas City. H. A. Warren has been made manager of this District, which covers Missouri, Kansas, Colorado, Nebraska, Iowa and parts of New Mexico, South Dakota, Illinois, Arkansas, Wisconsin and Minnesota.

Several organization changes within GEs New York District have been announced by T. F. Barton, commercial vice president. G. H. Reid is appointed tant district manager. W. E. Brown has relinquished his position as manager, Central Station Division, but will remain to handle special assignments. H. M. Sliber is appointed district manager of the Central Station Division, and R. M. Darin assistant district manager of this on. Horace Zimmer is appointed District manager of the Industrial Di-9, which is in addition to his present tion of district manager, Transporta-

MANUFACTURERS Speed Pipe Bending THIS EASY GREENLEE WAY!



One stroke of quick-positioning lever brings shoe snug against pipe, ready for application of pressure. This short-cut eliminates time and labor of hand-pumping shoe into position. Then lever handle is transferred to operating lever.



Operating lever is forced down to its lowest position, releasing pressure. Handle is then transferred to the quickpositioning lever for withdrawal of ram. Pipe can be withdrawn entirely or moved for second bend. Then the process in steps 1, 2 and 3 is repeated.



By pumping operating lever handle, hydraulic pressure is exerted on pipe. Bend is complete when contour of shoe is almost filled. Graduations on ram permit operator to identify precise length of travel of ram, for making exact, duplicate bends.



Quick-acting cotter clips (an exclusive GREENLEE development) make change to another type of pipe-bending attachment a fast, easy job. With attachments, one bender can handle pipe, rigid and thin-wall conduit, bus bars and larger sizes of tubing.

Whatever the bending job ... pipe up to 41/2", rigid and thin-wall conduit, tubing, bus bars . . . there's a GREENLEE to do it better, faster! It's a portable tool, compact, easily carried to the job - packed in wooden carrying case.

CATALOG 33E



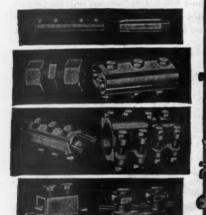
Get complete facts on the complete line of GREENLEE Hydraulic and Hand Benders and other time-saving tools. Write foday! Greenlee Tool Co., Division of Greenlee Bros. & Co., 1744 Columbia Avenue, Rockford, Illinois.





For any good Straight or Parallel Connector, see the COMPLETE line

These illustrations can only suggest the wide variety in the Penn-Union Catalog . . . a complete into . . a complete line of Reducers . . . Screw type . . . Split Sleeve type . . . Shrink fit . . Universal Parallel Clamps . . . E-Z Connectors that take a wide range of conductor sizes.



Also . . . the most complete line of Service Connectors, Tee Connectors, Cable Taps . . . Elbow and Cross Connectors . . . Bus Supports, Clamps, Spacers . . . Gring Clamps, Terminal Lugs.

Penn-Union connectors are the first choice of leading utilities, industrials, electrical manufacturers and contractors-because they have found that "Penn-Union" on a fiting is their best guarantee of Dependability.

PENN-UNION **ELECTRIC CORPORATION** ERIE, PA. Sold by Leading Jobbers



tion Division; and H. M. Bardin will be manager sales of the Federal and Marine Section, which has been transferred from the Transportation to the Industrial Division. R. B. Ransom is appointed manager of the New Haven office, and J. J. Pascher will manage the Hartford office.

SOUARE D APPOINTMENTS

Frank Roby, who left the Industrial Controller Division in 1942 to enter the armed services, has rejoined the Square



FRANK ROBY

D Company as sales manager of that Division, with headquarters in Milwau-

T. B. Martin has assumed the duties of director of advertising for both the Detroit and Milwaukee electrical divisions.

Dwight A. Roehm will continue his advertising activities for the Detroit plant under the title, advertising manager, Detroit Division. J. Clifton Carr continues in his capacity of advertising manager of the Kollsman Division, with headquarters in Elmhurst, N. Y.

SIDDALL APPOINTED MANAGER OF COMMERCIAL ENGINEERING

Joseph J. Siddall has been appointed manager of commercial engineering of the H. H. Roberston Company.

During the past ten years Mr. Siddall has served the company in the capacity of



J. J. SIDDALL



Contains detailed descriptions of models we're now making.

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We manufacture Volt-Ohm Milliammeters, Insulation Testers, Signal Generators and Tracers, Industrial Analyzers, Voltage Testers, etc.

SUPERIOR INSTRUMENTS CO.

Dept. 156

227 Fulton St. New York 7, N. Y.



Electrical engineer and as assistant manage of the Steel Floor Department. His work is concerned with the development of the Robertson Company's field policies, including presentations to various scientife societies, universities, and associations. He is active in the International Association of Electrical Inspectors, the Municipal Signal Association, the Pacific Ruilding Officials Conference of America, Coast Building Officials Conference, the the Producers Council, and in the Electrical and building fields throughout the United States.

WESTINGHOUSE CHANGES

The appointment of L. G. Burwinkel as assistant to vice president has been announced by R. A. Neal, vice president and sales manager of the Westinghouse Electric and Manufacturing Company.

Robert W. Pritchard, a member of the Westinghouse Lamp Division's sales staff in Bloomfield, N. J., for 20 years, has been appointed assistant to Russell E. Ebersole, lamp sales manager.

Leonard C. Blevins has been named sales manager of the Meter Division of Westinghouse. H. L. Buechner was appointed to succeed Mr. Blevins as Watthour Meter sales manager.

Norman R. Miller, application engineer at San Francisco for the Marine Division, for the past two years, has been transferred to Los Angeles, Calif. to fill similar post.

Robert E. Blasen, just retired as lieu-terant colonel in the U. S. Army Corps of Engineers, has been appointed an application engineer for the San Diego, Calif.

Official changes in names of two divisions of Westinghouse to better describe their expanding functions now and postwar have been announced by Walter Evans, vice president in charge of all Company radio, radar and electronics activities. Involved in the changes are the former Radio Division, which now becomes the Industrial Electronics Diision, and the former Radio Receiver Division, which becomes the Home Radio Division. Each Division will continue under its present direction.

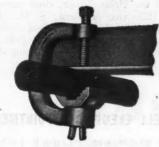
John F. Myers has been appointed manager of the Middle Atlantic District of the Westinghouse Electric Supply Company. H. C. Lease has been named to succeed Mr. Myers as manager of the Washington branch. Mr. Myers succeeds H. M. Gansman, who will retire after 41 years of service with Westing-

Houston B. Watson has been appointed Apparatus and Supply manager of the Southwestern District of the Supply many. Mr. Watson succeeds W. G. Sterett who recently resigned.

esi

A. W. Robertson, chairman of Westse has announced the purchase of Atlantic Elevator Company of Philaa, Pa. Fred B. Brust, first vice sident of the Atlantic Company, will time as manager of the new Westglouse operation. Ellis L. Spray, vice president and gen-





"Bull Dog" Pipe or Conduit Hanger

Sturdy and dependable, most economical. Easily installed. No need for drilling or for straps.



No. 150 Box with No. 207 Nozzle

Adjustable watertight box for use in fire proof floors with wood flooring finish. Shown with 207 Nozzle.



"Bull Dog" Insulator Support

For fastening percelain and glass insulators to exposed steel frame-work. Non-Slip, sure grip.



No. 252-R Floor Box with Nos. 206 and 207 Nozzle

Two-gang Box. One cover plate with 1/2" Flush Brass Plug and the other cover plate with 2" Flush Brass Plug.



No. 284 Nozzle with No. 200 Cover Plate

mpact Duplex Receptacle Nozzle own with $\frac{1}{2}$ " brass pipe exten n. Furnished also with $\frac{3}{4}$ " pipe



"Bull Dog" BX Cable Staples

Quality counts even in this small item. Cartons, Kegs and Barrels.



It's YOUR future-Make the most of it!

Start now to earn the bigger pay in electrical repair



Was there ever such an opportunity to get started in electrical maintenance and repair -and at top-notch wages? Are you ready with experience and ability—to cash in on it? Others are getting just the sort of background needed—quick! practical!—to handle the great variety of electrical maintenance and repair work TODAY—from this well-known electrical library. You can

Electrical Maintenance and Repair Library

5 volumes, 2042 pages, 1721 illustrations

Gives you the "know-how" to tackle any wiring or motor job. Five books show you HOW-to install all types of motor and generator units-to inspect and repair motor starters and generators-to diagnose motor and generator troubles—to figure new windings for old cores, DC and AC windings to test armature windings, test induction motors, etc., etc. The new book is full of trouble-shooting charts that show quickly symptoms, causes, specific remedies, etc.

Includes trouble - shooting book

New in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's Troubles of Biostrical Equipment, a hardy back giving helpful maintenance information, special troubles described by the property of the property of the property of the property in the property of the

10 days' examination Easy monthly payments

We want you to examine this Library for 16 days. If you don't want them at the end of that time, there's us obligation to keep them. On the other hand if you decide you want the kelp these books can give, start the sail menthly payments then, and in a short time the books are yours, right while you have been using them. Send the esupon teday.

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McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y.

Send me Electrical Maintenance and Repair Library, 5 volumes, for 10 days' examination, If I find the books satisfactory, I will send you \$1.00 in 10 days, and \$2.00 a month until \$15.00 has been paid. Otherwise I will return the books postpaid.

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City and State		 	
Firm or Empl	ayer	 	
Position		 	

eral manager of the Westinghouse Electric Elevator Company, has announced the creation of two separate divisions to carry on the work of the Company, the Air Conditioning and the Elevator Divisions. Ross Rathbun, formerly man-ager of air conditioning, has been appointed manager of the expanded Air Conditioning Division, which now includes the Precipitron; and Walker G. White, formerly sales manager, has been named manager of the Elevator Division. George F. Begoon, who for several years has directed commercial development of the Precipitron, has been named manager of the Precipitron Department of the Air Conditioning Division.

COLE ELECTRIC **ELECTS OFFICERS**

Harold J. Vorzimer, vice president in charge of sales since 1920 has been elected executive vice president of the Cole Electric Products Company, Inc. of Long Island City. The other officers elected are Helge Jensen, chief engineer since 1928, vice president; S. M. Shor, in charge of estimating and field engineer since 1927, vice president; and Jefferson J. Vorzimer, in charge of purchasing since 1930: assistant secretary.

HOWELL ELECTRIC APPOINTMENT

The appointment of Leroy F. Keely as general sales manager of the Howell Electric Motors Co., Howell, Michigan, has been announced.

Mr. Keely has spent more than 20 years in the development, sales and application of electric motors. He is a graduate of the electrical engineering school of Michigan State College. Subsequently at the Mellon Institute he did special research and development work on insulation problems as applied to electrical motors.

TRUMBULL APPOINTS NEW OFFICERS PACIFIC DIVISION

Carroll D. Hepler was recently appointed president of the Pacific Division of the Trumbull Electric Mfg. Company, with factories at Seattle, Washington and Los Angeles, Cal. Mr. Hepler will be located at the Seattle plant. He succeeds John H. Trumbull, who retired as president on January 1.

Alfred G. von Normann, former manager of the Los Angeles plant, has been elected vice president. William E. Froude will act as secretary-treasurer.

No change has been made in the organization of the San Francisco office. Lester Siebert, president, Charles E. Barkis, vice president, Walter C. Hirsch, treasurer and Leo M. Kerkhof, secretary and assistant treasurer, will continue as in

Wanted ENGINEERS

Radio

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- Mechanical
- * Factory Planning Materials Handling Manufacturing Planning

Work in connection with the manufacture of a wide variety of new and advanced types of communications equip ment and special electronic products.

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*Also: C. A. L. Locust St., Haverhill, Mass. Applicants must comply with WMC regulation

110-Volts A.C. from Direct Current with KATOLIGHT ROTARY KON-VERTERS Change 32, 110 or 220 value D.C. to standard 110-volt, 60-cycle A.C. for operating radios, electronic & sound apparatus, electric signs, A.C. appli-

ances, etc.



KATO ROTARY KONVERTER, 225 Welts Pioneers in the Building of Small Rotary Converters

At present Kato's entire production must be directed to furnishing convert-

ers on priority orders.

Also manufacturers of A.C. and D.C. generators ranging from 350 wals through 25 K.W.; power plants; Frequency Changers; and Motor Generator Sets.

KATO ENGINEERING CO.

642 N. Front St., Mankato, Minn

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Electrical Contracting, April 1945

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Chicago Electri Triangle Conduit and Cable Co., Inc. of New Brunswick, N. J. has announced the appointment of Edson L. Harris of 5038 31st Avenue, Minneapolis, 6, Minn. as district manager of the territory of Wyoming, Montana, east of and including Billings, North and South Dakota, Wisconsin, Minnesota, Michigan, north of a line drawn from Sioux City to Dubuque and including those two cities. Mr. Harris will be under the supervision of Horace E. Fritschle, mid-western district manager, in Chicago.

Arrangements have recently been concluded between Edwards and Company, Inc. of Norwalk, and Warren Telechron Company whereby Edwards and Company will sell Telechron program and clock systems. As soon as war restrictions are lifted, Edwards and Company will manufacture its own line of program and clock systems using Telechron motors and mechanisms.

The Standard Transformer Company of Warren, Ohio, has appointed A. P. Dearing of Dearing & Company, 1028 W. Rayen Avenue, Youngstown, Ohio, its sales representative. His territory includes Trumbull, Mahoning, Columbiana counties in Ohio, as well as Mercer and Lawrence counties in Pennsylvania.

Captain John J. Healy, who has been with the Army Air Forces for the past 33 months, has been assigned to inactive duty and is back as Northwest representative for the Copperweld Steel Company. He will be under the jurisdiction of the Chicago Office and will cover the States of Minnesota, North and South Dakota, Montana, the Upper Peninsula of Michigan and the northern portion of Wisconsin—the territory he covered prior to his colistment.

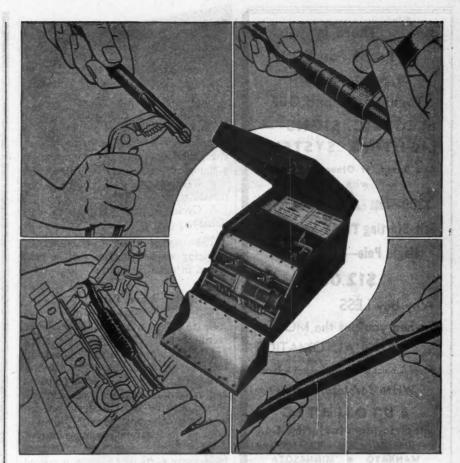
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The Stanley & Patterson Division of the Faraday Electric Corporation has moved to 434 Newbury Street, Boston 15, Mass. The machinery and personnel of the Holtzer-Cabot Signal Division as well as equipment and personnel from the Faraday plant at Adrian, Mich. will be combined at the new address.

Paul E. Freiwald is to be the sales manager of this Division and George Rick will be in charge of manufacturing.

Despatch Oven Company of Minneapolis, Minn. has opened a new sales and field engineering office in the La Salle Wacker Building, 221 N La Salle St., Chicago 1, Ill.



MINES KIT BOX VULCANIZER ASSEMBLIES

Provide Cable Safety · Reduce Operating Costs

Cable repairs, so important in electric cable maintenance, can be made quickly with a MINES Kit Box Vulcanizer Assembly. Makeshift, temporary repairs to cables, often dangerous to life and property, are a thing of the past with a Mines Kit on the job.

The Kit Box Assembly VDIR 213, shown above, will handle cables up to 13% in diameter and will accommodate a mold up to 13" in length. Comes packed in a sturdy, light steel carrying case, 23" x 1534" x 13", and weighs about 120 pounds. Easy to move to cable trouble. Total heating capacity 1200 watts, operates on 115 volts AC.

This portable Kit Box contains all necessary supplies and tools. The Vulcanizer itself is mounted right into the Kit Box. Each unit is complete with heating elements, thermostatic controls, cable holding clamps, power input cord, wrenches, and an operating instruction manual.

Also available in smaller size and Bench type. We also make Vulcanizers for all size cable and electrical conditions. Write for Bulletin RV-104K.

MINES EQUIPMENT COMPANY

4231 Clayton Ave., St. Louis 10, Missouri

Makers of the Connector with the Water-Seal

There Is A Profit For YOU In Automatically Turning ON and OFF ELECTRIC SIGNS — LIGHTING SYSTEMS

And Dozens of Other Applications with the

2200-Watt AUTOMATIC
Self-Starting TIME SWITCH
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IMMEDIATE DELIVERIES

CHICAGO TOGGLE BOLTS

You can't beet these dependable Chicago Toggle Bolts for fastening to lath, plaster, hollow tile or any type of hollow wall. Furnished in 25 sizes from ½ x 2" to ½ x 6". All types of screw heads or toggle-head riveted on with nut. Immediate deliveries. Call your wholesaler. Write for Catalog on Chicago Anchoring devices.



Electronics

[FROM PAGE 101]

ful trouble-shooting is to be done on electronic resistance welding controls:

- 1. A reliable volt-ohmmeter.
- 2. A three-inch cathode-ray oscilloscope (modified to read d-c).
- 3. A split-core current transformer and portable pointer-stop ammeter, or a clamp-on pointer-stop ammeter.
- 4. Receiver-type tube tester (optional).
- 5. Cycle-recorder or counter (optional).

The use of these instruments in servicing welder controls will be described in detail in future.

Spare Parts

Spare tubes, transformers, dry-type rectifiers, fuses, and indicating lamps are the most important items to keep in the spare-parts cabinet of the maintenance stock room. The small resistors and capacitors used on most controls should also be kept in stock but can be temporarily replaced with parts obtainable in local radio supply stores. Most welding control manufacturers have spare parts lists already prepared which will give the necessary catalog numbers required for ordering.

Upon receiving the wiring diagram for a welding control, it is important to examine the material list and make sure that your stockroom has at least one spare of each of the various tubes used in the control. The quantity stocked should be governed by the number of welding controls located in the plant. Determine from this material-list the catalog numbers of transformers and dry-type rectifiers. These parts should also be stocked according to the number of controls employed and the degree of regularity with which they are used.

The conventional voltage transformers can be temporarily repaired or rebuilt in the average maintenance shop. However, there should be spare transformers on hand. The most popular controls generally employ the type of relays which are used on other forms of electrical apparatus and so in all probability are already carried in the stockroom. Special forms, such as telephone and time-delay relays, should be added to the spare parts stock.

A record of all replacements, as well as other service information, should be filed in the maintenance office. If an individual record is kept of each welding control, it is convenient to file the previously mentioned tube record cards along with this information. In case of trouble, reference to these records will enable prompt repair.

SIMPLICITY PLUS! NEW NON-INDUCTIVE CABLE RACK for INDUSTRIAL PLANT WIRING



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Radically different, the new M. & W. Non-Inductive Cable Rack is designed for A.C. or D.C. systems. Racked cables only partially surrounded by metal eliminates any chance of inducted current in the rack. Impedance reduced with cables mounted in delta formation, Rack of one-piece construction . . . installation of cables made quick and easy through the use of split bearings.

Send today for Bulletin C-S-51 . . . describes these and other M. & W. items.

Hook-Mounting and Bar-Type Cable Racks • Messenger Wire and "Bull Dog" Conduit Hangers • "Bull Dog" Insulator Supports • Ground Clamps

THE M. & W. ELECTRIC MANUFACTURING CO., INC. EAST PALESTINE, OHIO

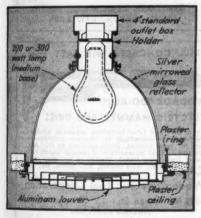


pected that fluorescent lamps which will produce an improved color quality of light will be available in early postwar which will be more desirable for general store illumination.

Fluorescent light sources, either hot cathode or cold cathode type, are ideally suited for decorative lighting effects from coves, indirect troughs, in wall display niches for background lighting, and for many display areas including show cases and wall cases.

Special Sales Areas

Many of the larger department stores have special department sales areas for such items as furs, beach apparel, furniture, home furnishings, glassware, appliances, rugs and similar



TYPICAL LOUVERED RECESSED UNIT for general lighting in Hutzler Bros. store uses 150, 200 or 300 wattincandescent lamp. Silver mirrored glass reflector permits high maintained efficiency.

merchandise. The lighting technique described above as suitable for lighting the main sales floor area is satisfactory for lighting these special sales areas. The supplemental or decorative lighting may be varied, the same as the decorative treatment, to effect a change in appearance. For example, direct lighting from ceiling lights may be used to light the fur sales area, and daylight lamps may be used for the supplemental decorative lighting to create an atmosphere of coolness. In the beach apparel shop light amber or gold colored lamps may be used for decorative lighting effects to create a feeling of summer sunshine and warmth.

Beauty salons, restaurants, tea rooms, fountain shops and similar (Continued on Page 200)



1 1945

Insto-gas

TORCHES and FURNACES



Cut Your Soldering Costs 50% with Insto-Gas NOW

- Insto-Gas Torches and furnaces are the modern soldering tools that have reduced soldering cost as much as 50% for power companies, contractors; maintenance engineers.
- Insto-Gas produces an absolutely clean non-oxidizing flame, leaves no smoke, soot, or grease deposits to cause a faulty joint.
- A Cylinder of Insto-Gas lasts at lease five times as long as a Cylinder of compressed gas of approximately the same weight.
- Insto-Gas produces its own pressure, lights instantly, won't blow
- Insto Gas non-oxidizing flame makes perfect copper pipe soldered joints and leaves no soot or grease to be cleaned from the fitting.
- · Insto-Gas is recognized as the safest portable heat, listed by both Underwriters and Factory Mutuals

If your wholesaler cannot supply Inste-Gas, MAIL THE COUPON

Insto-Gas Corporation DETROIT 7, MICH.

Insto-Gas Corporation-Detroit 7, Mich.

Please send Insto-Gas Bulletin and name of nearest Distributor.

Address

areas in the department store should be lighted normally as would similar shops in standard commercial lighting practice, and will not be discussed in detail here.

Executive and General Offices

Twenty five or more foot-candles of well diffused and shielded general illumination should be provided for all office areas. Standard commercial lighting fixtures of appropriate design and finish may be used in accordance with normal practice. Indirect and semi-indirect fluorescent or incandescent type units are recommended.

Service Areas

Single lamp continuous row fluorescent units installed on the ceiling between stock bins provide good lighting for identifying merchandise in the stock rooms. Specially designed incandescent stock bin or stack light units are also used extensively. In the sewing and alterations department an intensity of 25 or more footcandles of general illumination should be provided, and supplemented by localized adjustable bracket lights on sewing machines. Stairways and corridors should be lighted in accordance with normal practice.

Flexibility Plus

[FROM PAGE 59]

be disconnected from the duct at that point and, when necessary, be quickly shifted to accommodate feeders that need correction most.

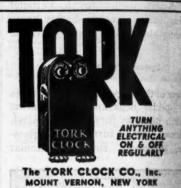
There are some 200 of these units providing approximately 3000 kva. of correction to feeders in the plant. Power factor is raised to a level of 92

Flexible Lighting

The electrical flexibility theme is carried into the design of the plant lighting system. Some 4,275 feet of 3-phase, 4-wire, 120/208-volt lighting distribution duct (1000, 750, and 500amp. capacity) originates at the various unit substations and wends its way throughout the plant to serve the lighting requirements. Distribution panels and branch circuits (the conventional conduit and wire type) are entirely eliminated by the use of a trolley duct

WHERE To Buy

Equipment, Materials and Supplies for Electrical Construction - Maintenance - Repairs



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WODACK "DO-ALL" ELECTRIC HAMMER AND DRILL

Saves time and labor installing expansion anchers. Two motions—reciprocal for hammer drilling—retary for twist drilling. Drills masonry to 1% dia. metal 3%. Easy to maintain. Universal motor, addirect from lamp socket. Weighs 15 lbs. Star drilling 17 diameters. Also chisels, bull points, etc. Als for bulletin.

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LAMP ANNUNCIATORS

Kirkland Bulls-I-Units are ideal for building lamp annunciators. Just provide the proper size holes



in the panel, then insert the Kirkland units and lock into phase

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sembly is then ready for installation. Connect incoming wires and place in service.

Write for Catalogue
THE H. R. KIRKLAND CO., MORRISTOWN, N.J.

Approximately 153,000 feet of 50-ampere Trol-E-Duct, mounted 18 feet above the floor in parallel rows on 10-ft centers, serves some 20,000 fluorescent fixtures in the plant. Connection to the lighting feeder duct is made through disconnect plugs (Fig. 7)—many of them of the dual type to serve two sections of trolley duct. Lighting



IIG. 8—QUICK CHANGE feature of fluorescent fixture mounting to trolley duct showing the terminal twistout plug on the drop cord (left) and the open hook and eye fixture support. Twisting plug to the left disengages it.

load is carefully balanced on the three phases. Normally on 10-ft. by 10-ft. spacing and suspended 13-ft., 6-in. above the floor, the fluorescent fixtures can be shifted at will to provide a concentration of illumination in a specific area or at a designated machine location—or additional fixtures can be connected to the duct in a matter of minutes.

The "quick-change" feature of fixture mounting simplifies lighting maintenance. Electrical connection is made through a terminal twistout plug (Fig. 8) which is simply inserted in the duct and twisted to make contact. The drop cord feeds the industrial type unit (three 40-watt, 3500 degree white fluorescent lamps and a Masonite reflector). Fixture suspension is by means of heavy duty weight supports designed for use with the duct. Open hook fixture rods fit into the open eye of the support.

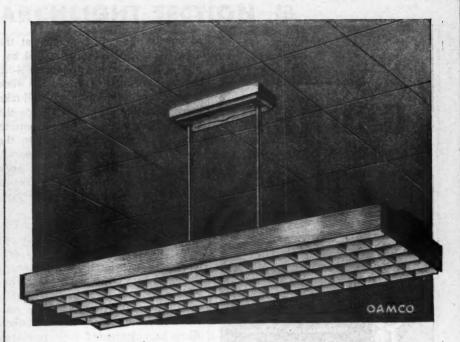
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1 1945

If a fixture goes out, it is simply removed and replaced with a good one. The faulty unit is then returned to the maintenance shop for checking and repair. A novel trolley-connector stick-clamp with a 3-ft., 9-in. handle is used

[Continued on page 202]



FOR RIGHT WORK LIGHT

The new OAMCO Egg Crate Louver Commercial Fluorescent Fixtures are designed and constructed to give high intensity illumination in stores, offices, drafting rooms and general working areas where maximum light plus fixture beauty are essential. These All-Steel Fluorescent Commercials have a welded steel louver finished in reflector white, side panels of diffusing ribbed glass and satin aluminum finished end covers, canopies and stems. The above units are furnished in the four 40-watt size for suspension or ceiling mounting and come completely wired including lamp holders, starters and high power factor ballasts.

Write today for Fluorescent Equipment
Catalog #106

OVERBAGH & AYRES MFG. CO. MEMBER OF THE RLM STANDARDS INSTITUTE

411 SOUTH CLINTON STREET . CHICAGO



to untwist the cord connector at the duct (distance between duct and bottom of fixture is approximately 4-ft., 6-in.). By using this, a man can work from an 8 or 10-ft. ladder and still take down a fixture with ease. Once the cord is disconnected, the supporting rods are simply unhooked from the duct support and the unit is free. A specially designed pick-up hand truck is employed to transport the fixtures from the maintenance shop to the various plant areas and vice versa.

The general pattern of electrical distribution previously discussed is not new. Bus duct and trolley duct systems have been installed in thousands of plants, both large and small. What Allison did was to add a few significant features that extended the convenience of an already flexible design. They have increased their insurance against possible "departmental-change tie-ups"; against "maintenance tieups." They have cut to an absolute minimum possible production loss due to electrical failures; have cleared the road to around-the-clock, trouble-free operation. The system they have installed-and operated without a single hitch-might well set the pattern for postwar industrial electrical system modernization.



HEAVY DUTY Carbon Lamps

FOR INDUSTRIAL USE

 Recommended for use where Long Life is essential, where Vibration is excessive, where Inaccessibility of lighting fixtures makes Replacement Difficult, where a Pilot Light is needed.

Available in a wide variety of sizes, shapes, candle power and voltages—standard and candelabra bases.

A large supply of all standard typ are carried in stock, thus assuring you prompt service at all time Write for catalog sheet 1-2 for full details or see your Electrical Wholesaler.



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SEARCHLIGHT SECTION

ELECTRICAL ENGINEERING OPPORTUNITY

Electrical manufacturer of nationally known motor control and power distribution equipment offers permanent employment in application and field engineering work to men with electrical engineering education or equivalent experience in sale or design of electrical equipment. Also excellent opportunities for qualified young men without previous experience to receive valuable training in an essential industry having a brilliant postwar future. Give full particulars, including education, experience, age and salary expected. ADDRESS—

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ELECTRICAL ENGINEER wishes permanent position. Familiar with design, application and maintenance of electronic, electrical and mechanical equipment. Employed several years in manufacturing plants, including chemical plant processing Amino Acids. PW-338, Electrical Contracting, 520 N. Michigan Ave., Chicago 11, Ill.

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experience selling, buying and installing electrical equipment. 84-339, Electrical Contracting,
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READ AIM . . . the illustrated monthly magazine for all those interested in Industrial Physical Fitness. Covers all phases sports, recreation, promotion, management. Special offer 7 issues \$1.00 plus free 34 page Personal Physical Fitness Guide. Write AIM Magazine, Clinton 28, South Carolina.

Additional
Employment Advertising
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Experienced electrical men. familiar with low voltage distribution systems to act as sales specialists in important District Offices on following: Panel boards, safety switches, enclosed circuit breakers, bus duct and load centers. Men accepted to receive full training at factory at company's expense before assignment. Write to Supervisor, Technical Employment, 306 Fourth Avenue. Pittsburgh, Pennsylvania, for application form.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.

PITTSBURGH 30, PA.

Electri

STEEL TOOL CABINET AND WORK BENCH



All Steel Cabinet, 22 ga. body, 18 ga. drawers, maple top, locking bar and clamp. cabinet 25" wide, 25" deep, 33" high.

11 drawers steel slides:

1 drawer 211/2"x25"x3" deep

8 drawers 10"x25"x4" deep

2 drawers 10"x25"x73/4" deep

All drawers full length

Olive Drab Finish—In Original Cartons No priority required

Suitable for filing cabinets, part bins, etc.

\$30.00 each-10% discount in lots of 6-25 units. 20% discount in lots of 25 or more.

F.O.B. Cars Columbus, Ohio Subject to prior sale Terms: Cash or check with order.

CLARK ATKINS COMPANY

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received by April 23rd appear in the May issue, subject to space limitations.

Address copy to the Departmental Staff 330 West 42nd St., New York 18, N. Y.

WANTED **Electrical Field Engineer**

Permanent Position Open in Large Industrial Concern

Excellent opportunity for the right man having substantial experience in office and field on design layout and installation of primary and secondary systems. power, lighting and substations in in-dustrial plants. State details of education, age, experience and salary required. Location, Michigan.

P-336, Electrical Contracting 520 N. Michigan Ave., Chicago 11, Ill.

ENGINEER FOR FLASHLIGHT BATTERY PLANT

Man thoroughly experienced in flashlight battery production, process and equipment, to supervise erection and operation of dry cell battery plant abroad. Excellent opportunity for high-calibre man.

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The right man for this job must have technical electrical education, extensive practical experience on modern industrial power and lighting layout and construction, and good command of language to enable him to produce sound, concise construction specifications. Give detailed outline of education and experience record, and mention salary desired. Location, Mich.

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Phone Now for NEW and REBUILT Electrical Equipment LECTRIC 63 CURLEW ST. P.O. BOX 51

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Channel-lock pliers, cee-tee pliers. Crescent wrenches, vice grips, open and hox wrenches, sockets, needle noze, side cutter diagonal pliers, sorew extractors, screw drivers, wheel pullers. Remember: we have it, can get it, or it is not made. Prompt shipment order today. COD. Catalogue free.

DEALERS TOOL SUPPLY Dept. EC 1527 Grand Av. Kansas City, Mo.

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that other readers of this paper can supply

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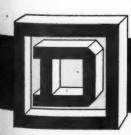


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